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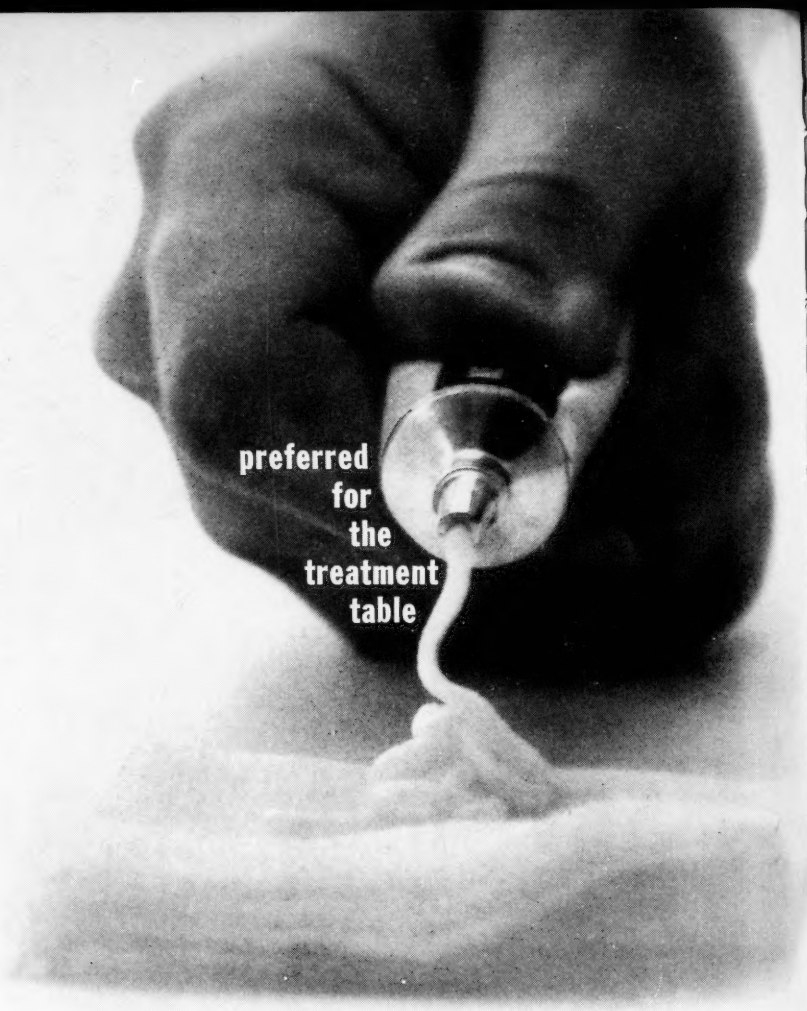

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Journal of Occupational Medicine

An Appraisal of the Exercise Electrocardiogram Test

Part I—Applications, Significance, and Criticisms

Richard Gubner, M.D., New York, N. Y.

DEVELOPMENT of our knowledge of coronary heart disease during the past generation has occurred concurrently with, and indeed has been largely due to, the broadened application and understanding of electrocardiography. Beyond the clinical syndromes of myocardial infarction and angina pectoris, it is recognized that there is a vast substratum of asymptomatic coronary disease which is not readily detected by conventional diagnostic techniques. Even in patients with angina pectoris, the standard resting electrocardiogram is normal in one-third to one-half the instances.[1, 2] Accordingly, various stress tests have been developed to detect latent impairment of coronary flow reserve, i.e., coronary insufficiency. Of these, the best known, safest, most readily applicable and standardized is the Master double two-step exercise test.[3]

Applications

The electrocardiographic response to exercise was employed as early as 1931 by Wood and Wolferth[4] as a diagnostic aid in angina pectoris, and a similar study was carried out at about this time by Goldhammer and Scherf.[5] Since its introduction, the exercise test has been used clinically chiefly for objective verification of angina pectoris, although as pointed out below, it has many other applications. Wood and Wolferth subjected 24 patients with angina pectoris to varying amounts of exercise and stopped exertion at the first suggestion of pain. Electrocardiograms were recorded before, several times during, and several times after the induced attacks of angina, as well as in an additional six cases with spontaneously occurring anginal attacks. Although changes in the ST segment and T waves were observed in 50% of their cases, even with only the three standard limb leads that were then employed, and although there were no untoward occurrences, Wood and Wolferth stated that they were not prepared to recommend the procedure as a diagnostic aid. Goldhammer and Scherf noted transient changes in the electrocardiogram after exercise in 30 of 40 patients (75%) with angina pectoris they studied.

The standard two-step exercise electrocardiogram test to detect coronary insufficiency was first applied by Missal[6] in 1938. Missal adapted this procedure from the standardized two-step test of cardiac function of pulse and blood pressure responses, introduced by Master and Oppenheimer[7] in 1929. Subsequently, Master popularized the standard two-step electrocardiogram test, and since 1942 he, and others as well, have employed the double two-step test, in which the same rate of exercise is maintained for a three-minute, rather than a minute and a half, period, the amount of standard two-step ascents determined by age, weight, and sex. Master

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still employs the single two-step test initially, and if the response is negative, repeats the test as a double test after a period of rest. Most investigators who employ standardized exercise carry out the double two-step test directly.

Either because of unfamiliarity with the procedure, or because of reluctance to carry it out, the exercise electrocardiogram test is still not generally performed. Thus, in a survey of electrocardiographic practice in the United State conducted by the author,[8] an analysis was made of electrocardiograms of 500 insurance applicants recorded by as many physicians throughout the United States, prior to and unrelated to application for insurance. In 99 of the 500 cases, electrocardiograms had been made because of a history of chest pain, but exercise tests for coronary insufficiency were performed on only 13 of the 99 patients complaining of chest pain.

It may be stated categorically that an exercise test should be carried out as a diagnostic aid on all persons complaining of chest pain whose resting electrocardiograms do not show evidence of myocardial disease, when patients are able to perform effort, except when acute or impending myocardial infarction is suspected. The scope of application of the electrocardiogram stress test extends far beyond its use in the differential diagnosis of chest pain. Since it is the most sensitive clinically available technique for the recognition of impaired coronary flow, it should be applied in the diagnostic and prognostic investigation of all circumstances which are known to be attended by a heightened incidence of coronary heart disease. These include hypercholesteremia and all other serum lipid abnormalities, hypertension, and obesity. The rate of development of clinical coronary heart disease as a complication in persons with these conditions, as well as in persons with diabetes and those who exhibit arcus senilis, is three to five times as great as the incidence in the normal population.[9] Since coronary heart disease is a prime cause of death in men beyond the age of 40 and in postmenopausal women, it appears desirable to employ this procedure whenever cardiovascular surveys are conducted in these groups.

The electrocardiogram exercise test is being increasingly employed in underwriting evaluation of insurance applicants, not only persons with a history of chest pain but also persons who exhibit equivocal electrocardiographic abnormalities in standard resting tracings, in the circumstances enumerated above which predispose to coronary heart disease, and in the case of an applicant for a large amount of insurance, particularly one in an older age group. Thus, at The Equitable Life Assurance Society of the United States, of 1,246 cases in which electrocardiograms were specifically ordered as part of the examination of insurance applicants during the first six months of 1959, double two-step exercise tests were requested in 634, or slightly more than 50%. A total of 3,863 cases with one or more electrocardiograms were analyzed at the Home Office of the Equitable during this period.

The electrocardiogram exercise test has been applied also in surveys of military personnel and in periodic employee health examinations.[10-12] Other areas of application of the electrocardiogram exercise test have been in the appraisal of functional recovery after convalescence from an attack of acute myocardial infarction to determine exercise tolerance,[13] and in the pharmacological evaluation of the efficacy of drugs in augmenting coronary circulation.[14] The test has been used also as a functional test in heart disease of types other than coronary heart disease.[15]

Significance of an Abnormal Exercise Test

Admittedly, the endorsement of such broad indications for the exercise electrocardiogram test must be predicated on evidence that abnormal responses are truly indicative of coronary heart disease and have prognostic significance. In their early report, Wood and Wolferth intimated on the basis of a very small number of follow-up fatalities, that electrocardiographic abnormalities in patients with angina pectoris developing after exercise were an unfavorable prognostic omen, but they stated that a much larger experience would be required to draw conclusions as to its significance. Such experience has been provided by the long-term follow-up studies of Mattingly and Robb at the Walter Reed Army Hospital,[16] more recently amplified by Mattingly,[17] and by a similar study of Robb at the Metropolitan Life Insurance Company.[18] In both series, double standard two-step exercise tests were performed: in the Walter Reed study among military personnel suspected clinically to have coronary disease, and in the Metropolitan Life study among insurance applicants in whom the test was carried out because of large amounts of insurance applied for, or because of a history of chest pain and suspicion of coronary heart disease.

Mattingly's study, begun in 1942 and continuing through 1959, comprised 1,920 cases, with an average follow-up period of more than five years; a total of 186 deaths occurred among

persons who had had exercise tests, and autopsies were performed on 78. Among the fatal cases, 61 patients had shown abnormal ischemic ST segment changes in their exercise tests, and in this group 87% died of coronary episodes within an average six-year interval. This contrasted with 62.5% coronary deaths among patients with equivocal exercise tests exhibiting the junctional type of ST segment depression, and 44% coronary deaths among those with negative exercise tests. In every instance with definitely abnormal exercise tests severe generalized coronary narrowing of the Grade 3 to Grade 4 type was found at necropsy. Among the entire group with positive exercise tests, including nonautopsied cases, 50% died within a 10-year period.

Robb[19] has recently reported a study of 922 insurance applicants, with an average follow-up of three and one-half years. Among 160 persons exhibiting ischemic ST segment depression, 11 deaths occurred, 10 due to coronary artery occlusion. The death rate among those with positive—i.e., abnormal—tests, was eight times that of those with negative tests. Persons who had the equivocal junctional type of ST depression (168 cases) had a death rate only slightly higher than those whose tests were negative.

These strikingly adverse findings corroborate the earlier joint study of Robb and Mattingly of 836 exercise tests performed in the period 1942 through 1951, followed up to 1952. In this investigation, coronary disease death rates per 1,000 years of observation were 49.2 for those with ischemic ST changes, 23.2 for those with junctional ST changes, 6.6 in the group showing T wave abnormalities after exercise, and 5.0 with negative exercise tests. Similar striking differences prevailed when an analysis was made of first coronary occlusion rates per 1,000 years of observation. Among ischemic ST reactors, the rate was 79.1, in the junctional ST group 35.2, among those with T wave changes 13.3, and among negative reactors 8.9. In a simultaneously reported study at the Metropolitan Life Insurance Company of 492 persons studied in the period 1949 through 1956 and followed to 1957, the death rate per 1000 person-years of observation was 22.2 in the ischemic ST segment group, 9.7 in the junctional ST group, and 8.0 in those with negative exercise tests. All deaths in those with ischemic ST segments changes were due to coronary disease.

A follow-up study by Franco[11] at the Consolidated Edison Company of New York revealed that in apparently healthy persons with abnormal exercise electrocardiogram tests, myocardial damage or coronary thrombosis subsequently developed in 20%, contrasting with only a 3% rate of development of vascular complications in the same period among those with a negative test. Another study similar to that of Franco was reported recently by Brody,[12] of the Greenbrier Clinic; in it the prognostic value of double Master two-step exercise tests performed routinely in the course of annual physical examinations on 756 business executives who had no history or symptoms suggestive of coronary heart disease was investigated. The average follow-up period was slightly more than four years, with a minimum follow-up of three years. Among 280 patients (mean age 53) with positive tests, 32, or 11.4%, developed classic angina pectoris, coronary insufficiency, or definite myocardial infarction within the 3- to 10-year follow-up period. Of 23 patients (mean age 54) who showed decided ischemic ST segment changes, 6 subsequently developed myocardial infarction and 10 developed classic angina pectoris; thus a total of 69.5% developed overt coronary heart disease. Of 476 patients who had negative exercise test results (mean age 49), 20, or 4.2%, developed classic angina pectoris, coronary insufficiency or definite myocardial infarction in the 3- to 10-year follow-up period.

There can be little doubt from these investigations that a definitely abnormal ST segment exercise response has very real significance; that it portends a greatly abbreviated life expectancy, and a vastly increased likelihood of future overt coronary heart disease and death from this cause. Among persons complaining of chest pain, there is fairly general agreement in the literature than an abnormal exercise test offers a valuable clinical objective indication of coronary insufficiency, and that abnormal responses occur in a majority of those with organic pectoris.

Criticisms of the Exercise Test

Despite the abundant evidence that the exercise electrocardiogram test provides the most sensitive clinically applicable method for the detection of coronary heart disease and that it has important prognostic value, it has not received unqualified acceptance. Thus, Gardberg[20] states that only rarely is the exercise electrocardiogram of any value unless an anginal attack is induced by the exercise, and Horlick[21] suggests that there is very little point in performing a Master double two-step test unless there is a reasonable suspicion of angina on clinical grounds. Such expressions of

skepticism derive largely from the circumstance that the criteria for abnormality initially proposed and popularized by Master led to the erroneous diagnosis of coronary insufficiency, due to false positive responses, in many normal persons. This is the most cogent criticism, and one which remains despite many attempts to refine criteria distinguishing abnormal from normal exercise responses. This question is considered in further detail below.

Other objections have been voiced to the standard double two-step exercise test. One, which experience has dispelled, is that the test is hazardous. This criticism was voiced in the early report of Wood and Wolferth, but time has proved this fear unfounded. There have been very rare instances where performance of the exercise test has been followed shortly by an episode of frank myocardial infarction. In the few cases which have been reported, it appears obvious that the test should not have been carried out, for the patients had premonitory signs of myocardial infarction and the resting electrocardiograms suggested myocardial involvement. In patients who have a recent onset of chest pain and in whom impending infarction is suspected, it is implicit that stress is to be avoided. However, in those whose chest pain is stable or in those who have recovered from the acute stage of myocardial infarction, no untoward results have occurred in the many thousands of cases collectively studied by Mattingly and Robb, Master, the author, and others. There is, accordingly, no basis to interdict the test, which imposes no greater stress than is involved in the performance of the routine activities of most persons. Obviously, exercise should be halted if, and as soon as, the patient develops pain or other undue symptoms, and even if the full quota of the test is not performed, ischemic electrocardiographic abnormalities as a rule precede the appearance of pain.

The criticism has been raised that a negative double two-step exercise test does not exclude severe coronary disease or even impending infarction,[21] but this does not in any sense vitiate the utility of the test. The objective clinical diagnosis of coronary insufficiency is a difficult one, and the fact is that the double two-step exercise test provides the best available method for the clinical detection of coronary insufficiency, with positive results, in the experience of most investigators, in the majority of persons with angina pectoris; and the test serves further to disclose coronary insufficiency in many asymptomatic persons.

The claim has been made—contrary to the general experience—that the test was found positive in 96.8% of 250 consecutive patients with definite coronary disease, and that negative single and double two-step exercise electrocardiograms "practically exclude coronary insufficiency."[22] Employing newer criteria to eliminate false positive responses, Master and Rosenfeld[23] state that they have observed only one false negative response (and four false positives) in 163 males with coronary disease. Such a high degree of specificity exceeds the experience of others, but complete specificity is too much to hope for in any biological test. It is probably specious to draw too absolute a distinction between negative and positive test results, not only because of the difficulty in evaluating the considerable number of borderline responses in distinct positive or negative categories, but also because the presence or absence of coronary disease cannot be stated in absolutes, since, in fact, major degrees of coronary artery narrowing are present in fully two-thirds of men above the age of 50 years.[24]

Some controversy has centered on the question of whether the exercise test should be standardized, as Master particularly has recommended, or whether, as advocated by Scherf,[25] the amount and type of exercise should be carried out individually according to the patient's tolerance. Gardberg and Rosen[20] have made the incisive statement that "the extremely bad practice of following the highly popularized criteria for the so-called 'standardized' exercise tests have caused a great many healthy people to be told that they have heart disease. Exercise cannot be standardized and the evaluation of individual electrocardiographic findings purely upon a statistical basis is open to serious question."

The careful long-term follow-up studies of Mattingly and Robb, cited in detail above, using the double two-step test, refute the criticism of the validity of statistical evaluation. While it must be acknowledged that there are many factors other than the foot-pounds of work in a unit of time which determine the manifestations of angina pectoris and electrocardiographic evidence of coronary insufficiency, this does not constitute a valid criticism of the electrocardiogram exercise test, any more than criticism levelled at similarly standardized loading tests in evaluating various organ functions, such as tests of liver, renal, or pulmonary function. In evaluating the individual patient with angina pectoris, it may be desirable to perform more or less exercise than is called for by the double two-step test or to introduce other variables, such as exercising after a meal or at cold tem-

peratures to help elicit abnormalities. However, when stress electrocardiogram tests are individualized, it becomes difficult even in the same patient to evaluate changes in successive tests unless the identical procedures are followed. Varying the amounts of exercise when tests are carried out in large groups, such as periodic health examinations, or insurance applicants, makes data assembled utterly meaningless. Not only is it imperative that the amount of exercise be standardized, but it is essential that the tests be performed under reasonably controlled circumstances (see discussion of technique in Part II). It is even more essential that serial tracings of particularly significant electrocardiographic leads be made at stated intervals after performance of the tests with identical location of precordial electrodes in the successive tracings. Only if such conditions of uniformity are observed can interpretation be made of tests carried out by different observers. Admittedly, such conditions may not be esssential, or at times desirable, in the case of a particular patient seen in private practice, but in the investigation of groups, particularly when more than one person carries out the tests, as much uniformity as possible is essential.

(The author's address is Equitable Life Assurance Society of the United States, 393 Seventh Ave., New York 1, N. Y.)

The bibliographic references cited in this article will be published with Part II of this series of articles, in a subsequent issue of this JOURNAL.

THE MENNINGER FOUNDATION
Topeka, Kansas

announces its

FIFTH ANNUAL SEMINAR FOR OCCUPATIONAL PHYSICIANS

"PSYCHIATRY AND OCCUPATIONAL MEDICINE"

March 7-11, 1960

This seminar, which is conducted in cooperation with the staffs of Topeka State and VA Hospitals, is for occupational physicians who are concerned with the health maintenance of a major segment of a company. It is designed to further the development of a psychiatric frame of reference applicable to the daily practice of the occupational physician. Its objectives are to help the occupational physician further his understanding of psychological motivation, improve his skills in assessing the emotional aspects of medical problems, acquaint himself with techniques of brief psychotherapy, enlarge his knowledge of psychiatric treatment methods and criteria for referral.

Two full days will be devoted to a discussion of *Psychodynamics*, covering conscious and unconscious motivation, constructive and destructive personality trends, personality mechanisms, and the work environment. Three half-day sessions will be devoted to *Principles of Psychiatric Examination*, the sub-topics of which will be psychological aspects of the initial examination, and psychiatric case study, with case demonstrations. An additional three sessions will be devoted to *Psychiatric Treatment*. Somatic treatment methods, principles of psychotherapy, and brief psychotherapy will comprise the individual sessions. In addition, there will be lectures on psychological, psychiatric and neurological topics of special interest to occupational physicians. Each lecture will be followed by a question period and a demonstration or discussion period.

Enrollment will be held to 20 physicians. Tuition for the seminar is $300, including the cost of lodging, meals and transportation from the hotel to the participating institutions. For further information write: Harry Levinson, Ph.D., Director, Division of Industrial Mental Health, The Menninger Foundation, Topeka, Kansas.

Factors Relating to Unsuccessful Vocational Adjustment of Cardiac Patients

David Gelfand, M.D.
David H. Lewis, M.D., Richard S. Monheit, M.D., Stanley Shapiro, M.D.,
Hope Thomson, M.S., Murray Levine, Ph.D., and John Hagan, B.S.
Philadelphia, Pennsylvania

THAT MOST men can return to their jobs after sustaining heart disease has become an established medical fact and has received increasingly wider acceptance by industry in recent years. In most instances the cardiac can be returned to his former job with few or no restrictions. Investigators have found, however, in each series of cases studied a certain proportion of cardiacs who have not returned to work even though employable from the point of view of their heart disease. The percentage of the total case load in the various reports[1-4] range from 25 to 40.

The experience of the present investigators,[5-6] working as members of a Cardiac Work Classification Unit* has corroborated the existence of this group of cardiacs who are not rehabilitated vocationally after the onset of heart disease. Despite the presence of heart disease in most of a group of 665 patients seen in the period 1952-1958, 92% were told that they could return to work. Follow-up of this group early in the history of the Unit revealed that 28% of these patients did not follow the recommendations of the Unit.

In the coronary patient, just as the body's reactions may fail or be themselves a source of further difficulty (embolism, renal shutdown, shock, etc.) so may the social and psychological defenses miscarry or be maladaptive (prolonged dependence on relief, pathological denial of illness with refusal to abide by medical regime, etc.). The attitudes of the community, the employer, and the doctor, as well as the patient and his family, figure in the final reintegration of the cardiac into the life that illness forced him temporarily to leave.

It is obvious that the evaluation of all these facets of a man's response to heart disease, from alterations in his T waves to the changes in relationships with his son whose aspirations for college have been dimmed by his father's heart disease, is beyond the scope of one person or one specialist's ability. This Unit, composed of medical social worker, vocational counselor, psychiatrist, and cardiologist, has attempted to render a composite picture of each cardiac patient by pooling the knowledge of each of its members to arrive at the broadest understanding possible of the impact of heart disease and the patient's struggle to rehabilitate himself.

Methods and Materials

Clinical Procedure

The Unit's clinical sessions were held in the Heart Station of the Philadelphia General Hospital. The patients were interviewed individually by each member of the team. The cardiologist's examination included a detailed history, physical examination, electrocardiogram, and orthodiagram. The vocational counselor's interview consisted of a desk audit to analyze the patient's job history and his present duties, including skill and physical requirements of the job. The patient's attitudes toward the physical, emotional, and performance requirements of his present or last job were also elicited. The medical social worker interviewed the patient and available family members to obtain information regarding any economic, personal, or

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*Cardiac Work Classification Unit of the Heart Association of Southeastern Pennsylvania.

family problems. The social worker also noted the impact of cardiac illness on the patient's family and upon his social and recreational activities. The interview by the psychiatrist elicited information on the patient's basic personality type, outstanding defenses manifested, prevailing moods and, cooperativeness. The psychiatrist was also interested in the patient's understanding of his illness and his reaction to convalescence.

At the conclusion of the individual interviews the patients were discussed in a team conference,* at which time each team member presented pertinent material, and free discussion followed. Since the interviews conducted during the course of this project represented at least the second visit by the patient, is was possible to note his response to the initial recommendations. On this basis he could then be classified as either successfully or unsuccessfully vocationally adjusted. Successful vocational adjustment (SVA) was defined as return to work without aggravation of cardiac disease. In the presence of cardiac symptoms on the job, the patient was placed in the group called SVA if it was judged that the symptoms were not being aggravated by the work performed, but would be appropriate to the patient's physical status even if he were not working.

The patient was classified as unsuccessfully vocationally adjusted (UVA) when *(a)* the patient was not working though physically able, or *(b)* the patient was not working up to recommended levels, or *(c)* the patient was working significantly beyond the recommended level with aggravation of heart disease.

At the conclusion of the conference on each patient the cardiologist conveyed to him the Unit's findings and recommendations. The same information was sent the following day to the industrial physician and to the patient's family physician for action. The team conferences were also recorded on magnetic tape and later transcribed to facilitate review of the case.

Collection of Data

In a review of the literature it was found that no forms precisely suitable for recording our data were available. A separate form for use by each discipline represented on the team was carefully constructed. Just as the operation of each discipline had to be systematized, so the team approach had to be systematized for the purposes of research. A team schedule was also constructed for each patient, noting in detail the synthesis of the Unit's judgment. A manual was constructed as a guide for the use of this team schedule. Provision of these schedules, both individual and team, has converted the operation of the Unit from an implicit to an explicit basis.

Selection of Patient Population

Analysis of the original 665 patients seen by the Unit revealed 214 inactive cases by virtue of retirement, death, moving away, or absence of heart disease. Of the remaining 451 active cases 117 were selected for detailed analysis, and these were reevaluated for this research project. Thirty-eight were found to be UVA, and seventy-nine were judged SVA.

Data on these will be presented in terms of a comparison of findings between the two groups, with SVA serving as a control. The aim of this project was to analyze in detail the characteristics of the UVA group and the factors responsible for this status. Therefore, every effort was made to find as many of these patients as possible, and no attempt was made to determine the frequency of their occurrence in the original 665 patients.

For simplicity and clarity, the findings have been organized under four team headings: medical, vocational, social, and psychiatric, with an additional section of information recorded from the team schedule. The analysis of results under each heading does not indicate the separate contribution of that particular team member, but rather represents a true product of the team approach in rehabilitation.

Statistics

Statistical analysis was carried out, using a t-test for the significance of the difference between two percentages. The percentage obtained for each item in the UVA group was compared with the percentage obtained for the same item in the SVA group. A finding was considered to have possible significance if the P value indicated that the difference in percentages observed would occur by chance less than 1 time in 10 ($P<0.1$).

Results

The results obtained from each individual schedule are prefaced by a short section outlining the procedure and method of analysis of the data.

Medical

From the individual schedule used by the cardiologist and from pertinent data in the

*During the team conference, the patients were asked to fill out a sentence completion test designed to elicit indirectly the patient's attitudes and feelings toward himself, others, and his illness.

patient's clinical file a medical data sheet was constructed. Fourteen items chosen for analysis represent the important parameters of the organic heart disease. They include age, sex, diagnosis, functional and therapeutic classification, symptomatology, hospitalizations, therapy, associated illnesses, physical examination, electrocardiogram, orthodiagram, recommendations, and course of illness from its onset. Each item was tabulated for the entire population of the study and the results grouped into three major diagnostic categories: (1) patients with coronary artery disease and/or arteriosclerotic heart disease, (2) patients with rheumatic heart disease or congenital heart disease, and (3) patients with hypertension. Comparison was then made between the UVA group and the SVA group within each diagnostic category.

In the first category, with respect to onset of illness, symptomatology, presence of associated illnesses, physical findings, orthodiagram, electrocardiogram, and recommendations, there are no significant differences between the two groups.

The UVA group were hospitalized for their illnesses more frequently than the SVA group, and this difference appears to be statistically significant. In addition, in the UVA group there were fewer patients without any therapy and of those receiving therapy a greater percentage of UVA's took nitroglycerin (or other coronary vasodilator) than did the SVA's. These latter two differences, however, fall at a borderline level of statistical significance.

The differences might be interpreted as indicating more serious heart disease in the UVA group. No differences, however, are apparent in the objective evidences for more serious heart disease, such as symptoms, physical findings, orthodiagram, and electrocardiogram. From this it can be suggested that the differences obtained may reflect the emotional makeup of the UVA group. This point will be discussed in detail below.

The similarity between the UVA's and the SVA's in the category of rheumatic or congenital heart disease is even more striking. Only one difference between the two groups appears, *viz.*, the SVA's more frequently have a decreased exercise tolerance. This is exactly the opposite to what ought to be found if organic heart disease is the primary factor in determining unsuccessful vocational rehabilitation.

Comparison of the hypertensives is difficult because of too few UVA hypertensives. Inspection of the data, however, reveals no obvious differences.

When all the diagnostic categories are lumped together and a judgment made as to the course of the illness from onset to last visit, no significant differences appear. In like manner, when a judgment was made as to therapy, the UVA group were found to be receiving more therapy in adequate amounts more frequently than the SVA group. The reasons for believing that this does not represent more organic pathology in the UVA group have been cited. Furthermore, since this judgment was rendered by one cardiologist from the data in the patient's clinical file, comparison was made between this opinion and that of the team as a whole at the time of the follow-up interview. The team opinion indicates, in contradistinction, no significant differences in the adequacy of care.

It may be concluded from these data that the UVA group cannot be differentiated from the SVA group on the basis of organic heart disease, either from the subjective information provided by the patient or from the objective data of cardiovascular evaluation. The factors that separate these two groups must be sought elsewhere.

Vocational

The vocational counselor's schedule was designed to evaluate those factors which are generally considered to contribute significantly to vocational adjustment. The factors considered are those competently considered to represent the basic requisites for obtaining and holding a job in addition to age, sex, and marital status.

Specific areas analyzed were work energy output, stability of employment, stability of the job, changes in the job, supervision, performance requirements, and skill. The educational background of the patient, his father, and his spouse were also considered, as well as the job status of the father.

Statistically significant differences between the UVA and SVA groups were noted only in the area of job stability. The UVA were more often found in jobs which were short-term in nature, whether temporary or seasonal. In addition, they were more likely to move from job to job. It is possible, therefore, that the reason the UVA group was unemployed was due to the fact that they were more likely to be found in those types of jobs where unemployment rates would be expected to be higher. As educational background, skills attained, and performance requirements were not significantly different, there is no vocational reason why they should be in inherently less stable jobs or moving from job to job more frequently. An alternate explanation is that this finding, too,

is in keeping with the emotional makeup of this group, as will be discussed below.

Social

The data obtained by the social worker were recorded on the following schedules. An economic schedule was designed to assess the predisability level of income, current income, sources of income, ability to meet living expenses, sacrifices by family members to compensate for loss in income, and the patient's feelings about his current economic circumstances in relation to the cardiac illness. The personal and family stability schedule was designed to assess the presence of social disorganization and stress in the family before and after illness, changes in responsibilities for household activities, changes in recreational activities, the patient's feelings about the effect of cardiac illness on the marital relationship, and early history of having been reared in a broken home.

From the data recorded it can be seen that prior to illness, both the UVA and the SVA groups had approximately the same level of income. After illness, patients in the SVA group on the average reported an increase in income. Naturally, because the UVA patients were not working, or were working below capacity, their average income showed a marked decrease. Most of the UVA patients who suffered a decrease in income had some additional source of support (e.g., earnings of spouse and children, social security). A third, however, of the UVA patients still reported that they were unable to meet all living expenses. Most of the UVA patients reported some sacrifice in the family because of the loss in income. These sacrifices consisted of moving in with relatives, spouses going to work, children leaving school, and dependency on relatives for support. Lesser deprivations resulted from a general shrinking of all nonessential items in the family budget, such as giving up vacation plans and regular entertainment.

In keeping with the finding that in more than half the SVA patients income increased after illness, these patients rarely reported difficulty in meeting living expenses. They infrequently reported that family sacrifices were necessary, and, in general, most felt that cardiac illness had no effect at all upon their economic circumstances.

The frequency of problems indicating social disorganization and family stress was about the same prior to illness in both SVA and UVA groups. Following illness there was no essential change in the frequency of such problems in the SVA group, but the frequency of problems increased in the UVA group. (Problems following on financial stress were specifically excluded from consideration.) The UVA's experienced also an aggravation of preexisting problems by the appearance of heart disease. Some examples of this may be cited. One patient had two grown, dependent, retarded children, and while at home was continually irritated by them. In another case, receipt of relief was followed by total family disintegration. Children became delinquent, bickering with his wife became intensified, and the patient became a problem drinker. A third patient reacted to the death of his wife by becoming socially isolated and personally helpless. For an excessively long period of time he was unable to accept any encouragement or any suggestions to alleviate the situation. These are problems which generally are not altered or rectified by external forces or environmental manipulation but which require internal strength and resolution to modify or alleviate the situation. Moreover, it was the social worker's impression that referrals to social agencies in many instances would likely be futile. In contrast, the problems of the SVA patients appeared to be more situational in nature, self-limited in time, and more amenable to resolution by some form of external manipulation. For instance, one patient was under pressure to find some means of caring for two motherless sons. Three patients were concerned and preoccupied with problems related to the immigration to the United States of their close relatives. Two patients were worried about the possibility of another pregnancy in the family. In another family there was a temporary inconvenience in living arrangements due to the return to the parental home of a married daughter with children.

In almost half the UVA group, there was an increase in responsibility for household activities, such as cleaning, shopping, preparing meals, and care for the children. This was not true in the SVA group, which tended to give up responsibility for household chores. In effect, there appeared to be a "feminization" of the UVA patient. While the vast majority of the SVA patients felt their illnesses had had either no effect or a positive effect on their marital relationship, a significant proportion of the UVA patients reported that their marriage had been affected adversely by their illness. This effect on the marriage may well have been related to the increased feminization of the patients.

In almost all of the patients in both groups, there was a sharp decrease in participation in

all forms of recreational activities, with the exception of watching television or listening to the radio. After illness more of the SVA group continued to pursue hobbies, to maintain membership in clubs and organizations, and to continue going to spectator sports.

In summary, it appears that when a cardiac patient can maintain his role as the wage earner in the family, as was the case with the SVA's in this study, his family experiences little or no economic deprivation and family relationships are relatively unaffected. However, if the cardiac patient cannot maintain his role as the wage earner, not only does his family feel the impact of financial stress but he experiences a sharp change in his role in the family (feminization), and chronic problems which were previously bearable but not onerous seem to be exacerbated. This sad state of affairs persisted in the UVA patients, even though medically they were judged capable of working more and despite the fact that such recommendations had been made in the past. Even though they and their families were suffering economically, these patients still were not able to follow vocational recommendations that would be likely to improve their financial lot and most still continued to express a depressed, helpless, hopeless feeling about their economic circumstances. The analysis of the social data has served to refine our understanding of the impact of cardiac illness on the patient and his family. However, what still remains unanswered is the question of why some patients were able to rehabilitate themselves successfully and some were not.

Psychiatric

Using the schedule devised, the psychiatrist conducted a semistructured interview with each patient. A definite diagnosis was made referring either to the basic character structure or to the predominant psychopathology that was present. Specific areas related to the patient's emotional adjustment to his disease were also available from responses recorded by the other disciplines and, in particular, the team schedule.

Diagnosis—The UVA group was composed predominantly of passive dependent individuals. The percentage of patients with this diagnosis was significantly higher than in the SVA group. Congruent with this was the finding that the UVA showed poorer control of his impulses (hostility) and tended to utilize more primitive defense mechanisms (projection, regression, and somatization). Also, the UVA, regardless of specific diagnosis, was regarded as more severely impaired psychologically.

The personality profile which emerged from the members of the SVA group was quite different. They consisted predominantly of obsessive-compulsive characters who were in strong control of their impulses. The defenses noted in the SVA group significantly more often were isolation and "avoidance" (a term used to imply a combination of repression and denial, since clinically it is difficult to differentiate the two). In general, they were considered to be less severely impaired psychologically than their UVA counterpart.

Knowledge of Disease—The psychiatrist endeavored to evaluate the patient's knowledge of his disease. Most patients expressed an interest in their disease, stated that they read about it, and at one time had been told their diagnosis by their physician. On questioning, however, most patients had such a poor understanding of their illness that the standards for considering what constituted adequate knowledge had to be set low. In the end a good response was considered one in which the patient knew his diagnosis and one other fact about his disease, such as coronary occlusion, "a clogging of the vessels that lead to my heart." Both SVA and UVA groups were equally poor in this respect.

Habits—There was a slight tendency for the UVA to restrict and cut down his activities—smoking, drinking, and the like—but the trend was downward for both groups in each item. There is a question of how reliable the patient's responses were here, since fear and desire to please may have influenced the answers given.

Attitude Toward Illness—The UVA group were much more disturbed than the SVA group. They were described as anxious or depressed as well as being more often evasive or guarded. In their attitudes toward their illness and the need for care, they were overconcerned. As a group they more often complained of symptoms which were deemed inappropriate to the objective findings of their disease. However, they were considered to be receiving as adequate medical care as their SVA counterparts. Subjectively, they reported the effect of their illness on their lives in dysphoric or pessimistic terms. In convalescence the UVA group showed a poor response. They either returned to work too early or prolonged unnecessarily their return. Either reaction connotes anxiety and failure to accept maturely the objective limitations imposed by their disease.

By comparison, the SVA accepted their illnesses and the need for care. As a group these patients appeared frank and spontaneous. Ques-

tioned on the impact of the illness of their ways of life, the SVA more often felt no effect whatever. The convalescent pattern was appropriate in lengths as compared with that described for the UVA.

Attitude on the Job—The UVA group appeared more frequently to have difficulty in their personal relationships on the job, and they also felt more frequently that they had too much responsibility prior to illness. This finding would be in keeping with the passive personality type shared by the UVA group. The failure to elicit similar complaints on the job from the SVA group would seem to corroborate the general clinical impression that the obsessive-compulsive is a good worker.

Personal Problems and Family Life—Although both the SVA and UVA groups showed a high proportion with major personal problems, the percentage of those with problems was significantly greater in the UVA group. When broken down into three categories—personal, family, and situational—the distribution was similar for the two groups, except for the weighting of situational problems in the UVA group, undoubtedly due to problems related to the job. However, the UVA group showed a greater proportion of multiple problems in both the personal and the family sphere. In addition, only in the UVA group was there an increase in the number of problems after the illness.

Team Schedule

In the foregoing sections organized under the headings of each discipline, much of the information was obtained from the parts I, II, and III of the team schedule. These sections dealt with the patient's attitude toward his illness, problems on the job, and social-emotional areas of difficulties.

Part IV of the team schedule was concerned with the assignment of each patient in the study to either the SVA or the UVA category. Of the SVA group 47% were working and were without symptoms. The remainder had symptoms which were judged not aggravated by the work performed. Of the UVA patients, 60% were not working at all, 30% were not working up to recommended levels, and 10% were considered to be overworking. Any patient who could not unequivocally be so categorized was, of course, excluded from the study. In addition, the team indicated those factors which seemed most important for the patient's rehabilitation status.

A breakdown of the factors so listed is shown as follows:

UVA	
Company policy plus labor market difficulties	7
Does not want to give up pension	6
Personality problems	28
Too selective of physical requirements of job, and refuses jobs	10
	51*
SVA	
Company policy plus job accommodates to illness	26
Minimum physical illness	19
Personality problems lead patient to continue working	18
Stable personality and family background	38
Miscellaneous	2
	103*

By inspection it can be seen that in the UVA, personality factors were the most frequent items considered to have contributed to the patient's status. External factors, such as company policy and labor market, and factors related to the illness played a larger role in the SVA group. This finding is congruent with the conclusions drawn from the analysis of social data that the UVA's were by and large coping with internal problems in their attempt to return to work, while the SVA's were faced more with external or reality problems.

In part V of the Team Schedule, the Unit recorded its recommendations on each patient. These were designed to supplement his current regime in order to convert him from UVA to SVA, or to insure that he remain SVA. As compared with the SVA's, the UVA's were more often in need of supervision of their medical regimen and also required additional therapy. Referral for psychiatric treatment was indicated for this group to a significant degree. In addition, they were considered to be in need of vocational and social agency referral more frequently than the SVA's.

Hypertensives

A review of the case load indicated that the hypertensives were disproportionately distributed in the SVA group. It seemed possible that the characterizations of the UVA and SVA groups might be determined in large part by this distribution of the hypertensives. To rule out this possibility, a separate statistical analysis was re-run on a subsample of the project case load in which all hypertensives were eliminated. The analysis was carried out on the group of patients with coronary artery disease and/or arteriosclerotic heart disease whose functional and therapeutic classifications were

*Since more than one factor could be listed for each patient, total number exceeds the number of UVA's and SVA's.

either II B or II C. This latter analysis had the added advantage of controlling the severity of the illness.

This subsample included 25 UVA and 40 SVA patients. The results of this analysis indicated no significant differences between the subsample and the entire patient population of this study. It may be concluded, therefore, that there was no unusual bias of the data due to the uneven distribution of the hypertensive patients. However, there still remains the interesting question as to the vocational rehabilitation of the hypertensives. What was there about this group of patients which disposed them to respond and adjust to their heart disease in such a uniformly successful way? One possible clue may lie in the fact that this group had one other strongly shared characteristic. Psychiatrically, they were almost exclusively diagnosed as obsessive-compulsive characters (14 out of 16). This finding is not new but corroborates the work of previous investigators in the psychosomatic aspect of hypertension.[7]

In this study, emphasis was placed on job performance: whether or not the cardiac returned to work after illness or diagnosis of heart disease and whether he kept within the limits of his physical capacity as recommended. Why the hypertensives accomplished this so well may be related to the psychological characteristics of the obsessive-compulsive. The compulsive individual is a rigid personality who places great emphasis on and takes pride in his ability to control himself. He is greatly concerned about the impression he makes on others, and his self-esteem is regulated in large degree by what others think of him. Thus, this type of personality uses defenses which minimize expression of emotion or any behavior which might imply weakness or loss of control. This is accomplished at the expense of the individual's psychic and somatic economy. Some have hypothesized that this psychic situation is the cause of hypertension—seen as a result of the discharging of tension and affect into the cardiovascular system. The present study, however, does not present any data to shed light on this interesting problem of etiology. What does seem probable, however, is that the psychological makeup of this diagnostic group would predispose them to approach their illness with a strong need to master it and to minimize the effect which hypertension might have on their capacity to work. This is understandable, since in our current industrial economy an individual's self-esteem is greatly dependent on his ability to maintain an adequate level of performance on his job.

Discussion

Detailed investigation of the organic heart disease failed to reveal any significant differentiating characteristics between the SVA and the UVA group. Patients employed up to recommended levels were no less ill than those who did not rehabilitate successfully. Controlled for the degree of medical illness by comparing only patients matched for diagnosis and functional and therapeutic classification, our findings remained substantially the same. Neither the type nor the severity of disease accounted for a patient being UVA. This does not mean that the patient's physical status is unimportant in his vocational rehabilitation. It does mean that adequate physical capacity is not sufficient to ensure successful vocational adjustment. Analysis of the vocational backgrounds of the patients likewise failed to provide the necessary differentiating characteristics of the two groups under study. Neither educational background, skills, type of job, nor physical requirements of the job were responsible for the patient's UVA status.

Only when the social and emotional climate of these patients came under scrutiny did features emerge which could differentiate SVA from UVA. Unsuccessfully adjusted patients showed that they had not generally come to any emotional terms with their illness. Overconcerned about themselves, they often appeared anxious, depressed, and bitter. There is even some suggestion that they either permitted or sought hospitalization more frequently than the successfully adjusted patients. The signs portending difficulty in emotional adjustment may appear early in the convalescent period when the patient either overrestricts himself or, on the contrary, even tries to do too much too quickly. Some of our clinical material suggests that an overly cautious physician who fails to reassure the patient adequately may play into the patient's concerns.

Heart disease appears to lead to some changes in the way of life. At the very least, recreational participation is reduced. At the extreme, complete personal and family disorganization may result. If the patient returns to work, or continues to work at some suitable occupation, the effect on his personal life appears to be minimized. Generally his income remains stable, and his role in the family is unchanged. It is as if the family now pulls together. The patient reduces his responsibilities at home to some extent, and if anything, the feeling between the family members is closer. The net result is that the "organism," consisting of the

patient and his family, has achieved some state of compensation for the stress introduced by heart disease.

If the patient does not return to work, or does not continue to work at some suitable occupation, much more family and personal disorganization is evident. Chronic family problems, once tolerable, now become overwhelming. Passive personality characteristics previously not disabling now may interfere with the patient's ability to cope with the situation. Maladaptive defenses, such as projection and regression, and an emphasis on bodily complaints now interfere with the patient's ability to perceive his situation realistically and to approach it with some intention of solving the problems which face him. Apparently when the patient relinquishing his role as the major provider in the family, the family unit itself changes and marital discord and other family problems become more marked. In response to his multiple personal and family problems, the patient feels helpless and hopeless. Particularly striking was the inability of these patients to follow recommendations which would alleviate their situation.

Prolonged pain, the development of heart failure, and arrhythmias are bad prognostic signs to the clinician in his evaluation of the patient's organic heart disease. In like manner, the development of a helpless, hopeless attitude toward old and new problems and the appearance of family stress and disorganization are bad prognostic signs for eventual rehabilitation.

The helpless, hopeless attitude of the UVA patient toward his problems dovetails with the impression of this group as generally passive, anxious and depressed, and seemingly without adaptive resources. Perhaps these passive character traits also help to explain the acceptance of feminization in the UVA group as indicated by their increased domestic responsibility following illness. Passivity is generally identified as part of the feminized attitude in the language of the unconscious mind while activity tends to be associated with masculine attitudes.

It would appear that the personality strengths and weaknesses of the patient are as important indicators of his eventual rehabilitation as knowledge of his medical history is of his physical recovery. In our successful patients, the team felt that success was often due to their stable personalities and work histories. They were often valued employees with a long history of staying on the same job. In many instances, the company valued the man sufficiently so that the job would be accommodated to whatever limitations he had. The UVA patients, on the other hand, before illness sometimes had personal difficulties on the job, and they tended to move more and be in less stable occupations. These are all suggestions that many of these patients had not capitalized on their personal resources prior to illness. After illness, their personality weaknesses continued to interfere with rehabilitation, just as they may have interferred with the patient's best development of himself. In many instances personality issues were felt to be directly responsible for the patient's UVA status. Sometimes the patient was unconsciously using his illness to justify inadequacies. Sometimes to gratify passive and dependent needs, he continued to rely on disability pensions even though our own examination showed the patient not to be totally disabled. In other instances the patients became highly selective of the physical conditions of work they would agree to accept, or they set very high goals for the jobs they wanted. In some instances patients actually refused to take suitable jobs offered them. Our results indicate that just as a stable physical organism is a potent factor in recovery from cardiac illness, so a stable personality appears to be a potent factor in successful rehabilitation.

The results show the clear-cut association of emotional status and vocational adjustment. While cause and effect has not been established, the importance of these observations cannot be underestimated. Any study of vocational rehabilitation of cardiac patients must take these factors into account. It is suggested that the team approach provides the most efficient means of accomplishing this goal. Moreover, the introduction of the team schedule into the operation of the unit provides the necessary stimulus for the forging of a true team judgment. We define a true team judgment as the synthesis of the opinions of separate but related disciplines. This approach minimized the pitfall of the team leader using the opinions of the other team members as he sees fit.

Summary and Conclusions

1. From a total patient population of 665 seen in a Cardiac Work Classification Unit, 117 cases were selected for detailed study. Of this number, 79 were SVA and 38 were UVA (successfully-unsuccessfully vocationally adjusted).

2. Factors which differentiate the SVA group from the UVA group lie in neither medical nor vocational spheres but only in the social psychiatric data.

3. The UVA group was found composed of individuals with passive-dependent personality structures and associated defenses. They reacted to their heart disease with overconcern, manifested by vigorous denial of the illness or by exaggerated adherence to restricted regimens. In their job history they were found to be in transient short-term jobs more frequently than the successful group. In their home life prior to heart disease they had no more problems than the successful group. The disease disorganized family life so that whatever difficulties had been latent and under control became exacerbated. No explanation for the failure of the UVA to reintegrate himself after cardiac illness was forthcoming from the analysis of the externals of family living or any situational circumstances. The maladaptive reaction to heart disease defined in this study as UVA may be explained on the basis of the vulnerability to stress the passive personalities shared by this group of cardiacs.

4. The SVA group was composed of predominantly obsessive-compulsive personalities. They reacted in a more realistic manner toward their heart disease with concern for minimization of the effect of the disease on their life. In the face of heart disease, the families of these men pulled together and made the necessary changes required to keep going. Of key importance in this respect was the continuance of the cardiac in some form of useful employment. It is suggested here that the adaptive reaction to heart disease seen in this group of patients is due to their stable conscientious personality structure. Without it their employers might not have been so willing to make accommodations in their jobs. Without it they might not have the orientation to mastery—to conquer the illness and keep going.

5. Schedules for collection of data and a method of approach to the problem by a team of specialists that are applicable for future investigators are described.

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TWELFTH ANNUAL MEETING OF
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Cardiacs Can Work

E. A. Irvin, M.D., Dearborn, Michigan

No one is so rich that he does not need another's help; no one so poor as not to be useful in some way to his fellow man; and the disposition to ask assistance from others with confidence, and to grant it with kindness is part of our very nature.

POPE LEO XIII.

THE CARDIAC in most cases not only can but should work. In the past and as recently as 10 or 15 years ago, there was a widespread but unjustified fear of heart disease. Our more recent experiences and a better understanding of the condition have brought about a great change in our attitude concerning the victims of heart disease. The term heart disease is broad and covers many types and degrees of disease. It is true that some persons may be completely incapacitated or even fatally ill, but there are a great number with lesser degrees of illness who could and should work. Unfortunately, in the past many persons with mild or moderate heart disease were made cardiac invalids because of the impractical approach on the part of the medical profession and lay advisors. Today, we have a much better understanding of many phases of the various types of heart disease and we know that some individuals should not work during the period of convalescence or healing and that rest is most advisable during this time. Many, after adequate convalescence and healing, may be able to return to their regular type of employment. There are many excellent examples of cardiacs who have returned to work.

Jocz[1] recently completed a study at the Chrysler Corporation of employees returning for work after acute coronary occlusions. In about 5% of these the industrial physicians could not agree with the views of private practitioners, and return to employment was denied. During follow-up periods that varied from three to six years about half of the remaining 95% continued to be satisfactorily at work, and about one fourth died of cardiac causes. The rest were retired because of age, had died of other causes, or were again disabled by heart disease. Absenteeism apparently was not a problem among those who had been returned to work.

Many similar studies, such as the one made at the Du Pont Company[2] and that made at the Esso Standard Oil Company,[3] show definitely that cardiacs can work if properly placed.

With the progressive aging of the population, heart disease is becoming more prevalent and, therefore, needs more consideration than ever before. In 1924, the year the American Heart Association was founded, the life expectancy for the American male was 54 years; today his life expectancy is almost 70. If this rate of increase continues, by 1980 approximately 40% of our population will exceed 45 years of age and nearly 26% of the total United States population will be in the age group from 45 to 64. This aging of our work force will present more problems to industry because we know we will have a higher incidence of diseases of the cardiovascular system.

Employment Problems

1. One of the basic employment problems in connection with the individual with heart disease is the private physician's lack of understanding of the employment problems, and poor communication between the private physician and the industrial physician—or the personnel or placement department—at the patient's place of work. The private physician understands the patient's medical condition but often lacks a true understanding of the patient's problem in regard to his work. This may be due to many factors. Frequently the patient wants to return to work and, in many instances, his economic situation is such that he will understate the amount of effort required on his job in order to obtain approval of his attending physician for his return to work. Many physicians have very little knowledge of the amount of effort required on various types of jobs in fac-

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tories, or in other phases of employment, and are, therefore, in a poor position to approve the patient's return to work. Many private physicians fail to put in writing to what extent they approve their patient to work when he does return.

2. Employment problems frequently confronting the employers are the result of poor counseling with the young cardiac while attending school. Frequently the young cardiac receives little advice in regard to preparation for future work. Many of these persons report for work without any special skill or training and, therefore, the employer is unable to place them except on a laboring job for which they are not physically qualified.

3. There is a general lack of understanding on the part of the medical profession and many employers in regard to the value of job placement. Many employers have not incorporated a job placement program in their employment department, and in many instances are totally unaware of the philosophy and value of job placement.

4. Many employers have great apprehension about hiring applicants with heart disease, based on potential liability under workmen's compensation laws. Under the laws of many states, or because of the liberal way their workmen's compensation commissions interpret the laws, disabilities and death related to heart disease become serious compensation cases. There are states which have proposed amendments to their workmen's compensation laws before their present legislatures which could make all deaths due to heart disease compensable. This presents a serious employment problem in regard to hiring or returning the cardiac to work.

5. At the present time, we have a definite lack of satisfactory tests to determine the physical capacity of individuals to perform work. In evaluating the cardiac in regard to his capacity to perform work most clinicians and most industrial physicians must rely upon the history, clinical findings, and past experience in dealing with the placement of cardiacs. This presents a serious problem from the standpoint of establishing definite procedures for returning cardiacs to work after disabilities resulting from heart disease.

6. The contracts between management and labor frequently present definite employment problems. In some companies labor and management have agreed, and have written into their contract, that individuals start their employment in a general labor pool and then progress into higher level positions according to their work record and seniority. This immediately rules out the cardiac who has ability and skill and who happens not to be physically able to start work in such a plant in a general labor pool. Many management and labor contracts incorporate provisions for noninterchangeable occupational groups and thus impose a definite handicap in placing individuals with heart disease on a special type of work. There is a lack of understanding of this problem on the part of certain segments of both management and labor.

Solving the Problems

There is a need for an educational program throughout the entire medical profession emphasizing the fact that individuals with heart disease can and should return to work. This philosophy must be stimulated in all branches of medicine.

We must emphasize the value of good communication between the private physician and the industrial physician. When the private physician approves the patient for regular work and the patient is not returned to his regular job when examined by the plant physician, the patient naturally questions the wisdom of one of the decisions. The industrial physician not only has a better understanding of the job requirements but recognizes other factors associated with the job, such as the problem of walking from the parking lot to the place of work, the distance from the locker room or the cafeteria to the place of work, and whether the patient will be required to climb a flight of stairs to the locker room or cafeteria. All these factors have a bearing on the placement of cardiacs at work. Most differences of opinion in this type of case could be avoided by better communication between the man in private practice and the industrial physician.

There is great need for an educational program in regard to counseling the students in school who have heart disease, and this counseling should include the parents. All too frequently the student with heart disease will be permitted to continue on a course through high school and college which in no way will prepare him for a definite skill to ease the physical effort required in his day-to-day work. School counselors should have an understanding of the problems of heart disease as it may affect the employability of these students, and be in a position to explain to the students and their parents the need for a thorough training in some special occupational skill.

The value of proper job placement must be emphasized to all physicians and all employers.

Job placement should include all employes and not be limited to those having some specific handicap, such as heart disease. Job placement from the physician's standpoint is founded primarily on two basic considerations: First, the physical requirements of the job and, second, the physical capacity of the individual. The job requirements can be determined by a thorough job analysis or by using the supervisor's knowledge to evaluate the job at the time of each placement. The physical capacity of the individual to perform work can be determined only by a good medical examination.

In the Ford medical program, job placement is used for all employes. Our physicians do an examination with four major objectives in mind: (1) to acquaint the worker with his physical status and to call attention to those abnormalities which should be corrected, at the same time seeking to stimulate in him a recognition of his responsibility for the maintenance of his own health; (2) to safeguard the health and safety of others by excluding those physically unfit to work or those with communicable disease; (3) to establish a record of the individual's condition at the time of employment, with particular reference to existing handicaps, disabilities, or limitations; and (4) to facilitate placement and advancement in accordance with the individual's physical and mental fitness. In order to be successful, any placement program must have close cooperation among the employment, medical, and supervisory personnel in the plant. From time to time there must be follow-up of a serious placement problem to be sure that the restrictions placed on the individual are being observed.

Some industrial medical programs have incorporated routine electrocardiograms as part of the clinical examination. In others, electrocardiograms are made in selected cases or selected age groups. I believe a practical approach to this is to make routine electrocardiograms for all persons over the age of 40, and for those under 40 when there is an indication in either the history or the examination which will justify the procedure. We have found that we must rely more on our clinical findings at the time of placement of the cardiac than on laboratory studies.

When, after evaluation, it has been determined that a patient can carry on in the regular labor market, there are certain principles which should be followed: (1) The patient should be returned to his previous job when it is at all possible. A man who has had a given job or a given task for many years finds it far easier to return to that same work than to unaccustomed employment. (2) When his previous job appears to be too arduous for a patient, the next choice is to return to the same job with appropriate work adjustments. Many times the employer is willing to take back an old and faithful employe, and to modify his work in accordance with medical recommendations. (3) If different or lighter work is needed this should be sought with the same employer. Though it is frequently difficult to find new employment for cardiacs, particularly those in the older age group, many employers are amazingly cooperative in their willingness to take back and help the old time workers. Often they can and will find a different and lighter type of work, in which case the patient is happier and much more at home than he would be if he were placed in totally new and strange surroundings. (4) If it is impossible to carry out any of the above procedures, then the next step may be to plan for vocational training for new work or to counsel the patient in finding a new type of employment.

As stated before, one of the major deterrents to full cardiac rehabilitation and employment is the present threat to the employer of sharply rising workmen's compensation costs due to awards for disability and death in heart cases. During the last 10 years there has been an increasingly liberal interpretation of the compensation laws in many states. Some states apparently no longer require an accidental injury or any unusual effort to establish causal relationship of work and disability from heart disease. It appears that mere presence on the job threatens to be essentially all that is required. The decision as to whether heart disability is actually caused or is aggravated by employment has been more and more removed from the hands of the cardiologist. Unfortunately, some of the liberal decisions have been influenced by the testimony of certain members of the medical profession, and it is quite true that even the best authorities have not always agreed as to what is cause and what is effect. The situation has been amply stated by Dr. Paul D. White, as follows:

> In this matter, the reticent and unsure position of the reputable medical profession, the honest differences of medical opinion and the elastic consciences of some physicians, the attractive possibilities of litigation in the eyes of some lawyers, and the appalling generosity of some juries are converting industrial compensation into sickness insurance which should not be the responsibility of industry alone. Public opinion and not medical opinion is now the deciding influence in this field.

All this makes the finely drawn medical distinc-

tions of cardiac impairment quite futile insofar as their influence on legal interpretation is concerned, especially in cases of aggravation of pre-existing disease. Our disputes will never be resolved by clinical statistics, nor indeed by any statistics or probabilities so long as attorneys can produce physicians who will testify to the validity of highly improbable possibility.

It must be admitted that a part of this extreme confusion arises from the fact that it is often impossible to prove, in the light of our present knowledge, whether a heart attack actually is set off or aggravated by special exertion or not. At this time the best authorities are not in agreement. Many believe that while exertion may cause sudden and immediate coronary insufficiency, it practically never causes coronary thrombosis. Some investigators believe that exertion may, through increased blood pressure, cause subintimal hemorrhages which result in coronary thrombosis; others doubt the occurrence of such a process. Beyond this, time elements are always confusing. The Committee on the Effect of Strain and Trauma on the Heart and Great Vessels of the American Heart Association is in the process of making detailed scientific studies of the mechanism and causes of coronary attacks in hope of building up sufficient knowledge to help in resolving this dilemma; but it is realized that to reach such conclusive results may take many years.

Meanwhile, various plans have been suggested to help in eliminating the threat of workmen's compensation as a deterrent to hiring and rehabilitation of the cardiac. "Second Injury Funds" have been introduced to encourage employers to hire individuals with a preexisting condition by limiting the employer's liability associated with the condition. It has been suggested that panels of expert cardiologists be established to pass on the merit of given cases and one is now functioning in Utah, where criteria have been set up for cardiac case compensability. While not the final answer, these are steps in a forward direction.

There is a great need for all interested parties—management, labor, private physicians, and industrial physicians—to study this problem of cardiac disability and deaths in relation to employment and make sensible, logical, and practical recommendations to legislative bodies in this country in order that we may solve this problem in a manner which will permit the employment of cardiacs without an undue risk to the employer. There is a correlative need for research to develop a better means of evaluating the patient's work capacity. Some studies have been based on oxygen consumption in relation to definite job demands. However, I think it is quite generally agreed by leading authorities that oxygen consumption is only one of many factors. Several research studies now in process may add to our knowledge in this field.

Finally, there is a need for a meeting of the minds of management and labor in regard to their collective bargaining agreements which at the present time interfere with the employment of cardiacs. The American Heart Association and physicians interested in the employment of cardiacs should make a very sincere effort to have top members of labor and members of management aware of the serious obstacles which they have placed in their contracts. This again emphasizes a lack of communication. I am sure that the leaders in the labor movement as well as the leaders of industry are sincere in their desire to help in the employment of the cardiac.

The rehabilitation of the cardiac is not a single responsibility, nor is it solely the responsibility of the employer and the industrial physician. This is a community responsibility. It is the moral and ethical obligation of all community resources active in rehabilitation to mesh their contributions so that the individual patient may best be served. Rehabilitation is not as much a means, method, or technique as it is a philosophy which should orient and permeate all medical and social sciences. The modern progressive physician starts the rehabilitation of his cardiac patient during the acute phase of the disease and follows through the entire course so that the bridge between convalescence and work is more easily traversed.

In some communities, work classification units have served a very useful purpose in the rehabilitation of the cardiac. At the present time there are approximately 50 work Classification units which are assisting the cardiac patient in his return to work. The basic and unique concept of the work classification unit is the evaluation of the patient with heart disease, or with presumed heart disease, by a team to determine his capacity for activity and work. The usual cardiac clinic is primarily concerned with diagnosis and treatment. In well-organized cardiac clinics, there is a social worker whose concern may also involve matters of occupational potential for patients, but it must be admitted that in many instances this takes a secondary place. The essence of the work classification unit is the philosophy of the team and unit approach with the physician, social worker, and vocation counselor, all working in close cooperation toward the primary objective of total evaluation for rehabilitation and work.

The question has been asked, and may well be asked, whether a work classification unit is justified in spending the amount of time and money which it must spend to accomplish what it can for a limited group of patients. The best answer to this probably lies in the fact that work classification units at the present time are still being set up as a pilot and investigative study. It is hoped that methods and procedures learned by these groups, as well as facts about employment of cardiacs, may make it easier for individuals and for other groups in the future to carry out similar rehabilitation measures, perhaps on a less formal and less time-consuming basis. If these units accomplish nothing more than promulgation of the philosophy of rehabilitation of cardiacs in the minds of physicians and employers, they will have accomplished a great deal. In addition to this, they serve as a medium for training young physicians in their responsibilities in the rehabilitation of cardiacs.

When it comes to the problem of evaluating a patient for placement or possibly for work adjustment in a given plant, the well-trained industrial physician, who is acquainted with cardiology, is definitely qualified to carry out the necessary procedures and make decisions in regard to placement. In the case of the smaller plants, plants not having a full time industrial physician, the consultation services of the work classification unit may be the most desirable and useful approach to cardiac rehabilitation.

In all placement problems there must be human understanding and assurances necessary to allay those anxieties which so frequently accompany disease.

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Heart Disease and Motor Vehicle Accidents

Harold Brandaleone, M.D., New York, N. Y.

MOTOR vehicle accidents kill approximately 40,000 persons each year and injure approximately 1,500,000 persons. This mortality and morbidity constitute one of the largest unsolved health problems in this country. Since the human factor is the most important single factor responsible for motor vehicle accidents, the physician, and particularly the industrial physician, must initiate and participate in research designed to determine the relationship between physical and mental factors and the etiology of accidents. The physician must be made to realize the importance of his contribution to the solution of this major problem.

It has been shown that a medical program associated with safety education and training can reduce motor vehicle accidents in industry, improve employee health, and save substantial sums of money.[1, 2] It has been recommended[3] that civilian drivers should be examined every three years up to the age of 45 years and every two years thereafter, and that commercial vehicle drivers should have preplacement examinations and periodic examinations every two years up to the age of 45 and annually thereafter. Physical and mental criteria have been established for civilian drivers, commercial vehicle drivers, and transportation vehicle drivers.[4, 5]

Raffle[6] has reported recently that in the year 1956 the medical department of the London Transport examined 2,607 drivers and found 369 of these unfit for duty. Of this number 97, or 26.3%, were found unfit for duty on the basis of disease of the circulatory system: Of this group 11 had angina pectoris; 39, coronary thrombosis; 31, hypertension; and 16, miscellaneous conditions. In other words, more than a fourth of all the rejections were of persons with disease of the circulatory system, and of this group a third were rejected for hypertension and half for coronary heart disease. These data indicate the necessity for medical evaluation of persons with heart disease who drive motor vehicles.

It is extremely difficult to obtain accurate data to prove the relationship between disease of the circulatory system and the actual etiology of an accident, because in most instances reliable records can not be obtained or because post-mortem examination has not been performed. However, studies are in progress that may produce the necessary data.

The following are some of the factors that must be taken into consideration in evaluating the cardiac driver and his ability to drive a motor vehicle: (1) type of vehicle, (2) driving conditions, (3) physical effort to be performed in addition to driving, and (4) degree of responsibility the driver will have for the lives of others. In connection with this, drivers may be divided into three classes[3]: (1) civilian drivers, (2) drivers of commercial vehicles, and (3) drivers of transportation vehicles.

It must be remembered that a truck driver, in addition to driving his vehicle, may be required to load and unload the truck; that he may be exposed to the emotional stresses of heavy city traffic; and that the taxi driver and bus driver have responsibility for other persons. Furthermore, the bus driver must maintain schedules, collect fares, answer questions of passengers, and maintain records. The long-haul driver, who is required to drive on high-speed highways and maintain a schedule must remain alert at all times. Fatigue must be avoided. The driver must be able to cope with unexpected difficulties that could occur with his vehicle.

Usually the commercial vehicle or public transportation vehicle is larger and heavier than the private vehicle. The heavy loads these vehicles carry may be varied and expensive. They may consist of perishable foods, inflammable or explosive materials, and, of course, human passengers. Accidents involving valua-

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Dr. Brandaleone, Chairman, Committee on Standards for Motor Vehicle Drivers, Industrial Medical Association.

ble loads of this nature may be expensive and serious.

In industry, the safe employment of the cardiac requires a thorough knowledge of the cardiac status of the employee and of the job requirements. For example, a cardiac patient employed on a delivery truck might be able to drive the truck without any difficulty, he might even be able to deliver light packages, but if he were required to carry heavy furniture or climb five flights of steps he might develop congestive failure. It is the responsibility of the industrial physician to evaluate carefully the individual employee and his job requirements, to determine the fitness of a candidate for his particular job. Therefore, the physician must know the job requirements in order to evaluate the employee properly.

The industrial physician must cooperate with the family physician in the evaluation and care of the cardiac employee, but the industrial physician should have the final word concerning the ability of an employee to continue in his driving job, because he has a better knowledge of the job requirements. Frequently, the cardiac employee may not tell his family physician the exact nature and severity of his work in order to maintain his job; for this reason the industrial physician may have to explain to the family physician the details of the job requirements and the reasons for the patient's inability to maintain that particular job.

The cardiac employee may become a serious liability to industry in one of two ways. He may become involved in an industrial accident, with a resulting injury that may be more serious because of the preexisting heart disease, or, if he is a driver, he may be responsible for a vehicle accident resulting in the injury of passengers with costly claims and litigation against his employer.

Recommendations for Supervising the Cardiac Driver

A comprehensive industrial medical program may be extremely helpful in supervising the cardiac driver and may be a vital factor in motor vehicle accident prevention. This may be accomplished in the following way:

1. Complete preplacement examinations.
2. Periodic medical examinations including a complete cardiac history, physical examination, laboratory data, and electrocardiogram.
3. Examination following absence for illness.
4. Early detection of any warning symptoms of heart disease.
5. Close collaboration with the family physician.

Recommendations to the Physician

One of the most frequent and difficult question facing the physician today is whether or not his cardiac patient should be permitted to drive a motor vehicle. As stated earlier, the answer to this depends on many factors such as the type of vehicle, the conditions under which it is to be driven, and the proper evaluation of the physical status of the patient. It must be emphasized again that the physician must evaluate each person with heart disease separately and that he must have a thorough knowledge of the job requirements before he can make an accurate decision concerning the driver's ability to drive a motor vehicle with safety.

The following discussion of the various types of heart disease is presented to assist the physician in determining whether his cardiac patient can drive a motor vehicle with safety.

Coronary Heart Disease—Sclerosis of the coronary vessels results in decrease of blood flow to the myocardium, which, in turn, may cause substernal pain of such a severe nature as to cause sudden disability. Drivers with pathology of this nature must be evaluated with great care before being permitted to drive. If the cardiac with coronary insufficiency develops varying degrees of heart block or arrhythmias he should be prevented from driving. If the patient requires frequent nitroglycerin for the relief of anginal pain he should not be permitted to drive.

Once a patent develops a myocardial infarction he must be carefully evaluated before he is allowed to return to driving. If his lesion has healed completely and his electrocardiograms are stable, he may be permitted to return to civilian driving but should not be permitted to drive a commercial or transportation vehicle,

Morris and Raffle[7] in 1954 showed that persons who have had their first coronary episode may be as much as 10 times more liable to have a further attack than the person who has never had a first attack. It was also shown that bus drivers are more likely to die in a subsequent attack than bus conductors. For this reason, the London Transport, in the interest of public safety, does not permit a driver with clinical coronary heart disease to drive.

Hypertensive Cardiovascular Disease—Hypertension in itself is not disabling for the safe operation of a motor vehicle, but the associated changes in the brain, eyes, heart, or kidneys may very well prove to be disabling. The exact level of blood pressure to be considered abnormal has not been accurately established. There are various opinions concerning the

upper limits for safe driving, extending from 150/90 to 200/100 mm Hg. Some investigators believe that levels up to 180/90 may be considered safe. There has been no proof that blood pressure per se should be used as a criterion in evaluating the safety of a motor vehicle driver. Each driver must be evaluated individually by the physician. When the vascular complications involve the optic fundi, the degree of impairment with respect to driving should be evaluated on either the loss of vision or the possible frequency of recurrent hemorrhages. When hypertension may cause congestive heart failure or severe angina pectoris, the patient should not be permitted to drive a motor vehicle. If the hypertensive heart disease is under control by therapy, the patient may be permitted to operate a private motor vehicle but not a commercial vehicle. Of course, whenever the possibility of a cerebral vascular accident or retinal hemorrhage might suddenly incapacitate the driver he should not be permitted to operate any type of vehicle. When prolonged hypertension becomes associated with mental change and kidney damage with azotemia or uremia, the patient should not be permitted to drive.

Rheumatic Heart Disease—Individual appraisal of each patient with rheumatic heart disease must be made in order to evaluate his ability to drive with safety. This appraisal should depend on the extent of valvular deformity, derangements of rhythm, progressive cardiac enlargement, and myocardial insufficiency. Of course the patient with aortic stenosis who might develop sudden syncope or death should not be permitted to drive any type of motor vehicle. Patients with aortic insufficiency and left ventricular failure should be advised against operating a motor vehicle. Those patients under complete control might be permitted to drive a private motor vehicle with safety.

Patients with rheumatic heart disease and mitral stenosis or insufficiency must be evaluated before they are permitted to drive a private vehicle. They should not be permitted to drive a commercial or passenger transportation vehicle. The patient with subacute bacterial endocarditis is likely to be too ill to drive a vehicle, but under no circumstances should he be permitted to drive.

Uncontrolled auricular tachycardia, flutter, or fibrillation should be a factor in preventing anyone from driving a motor vehicle of any type. However, if controlled by therapy and under constant supervision, a driver may operate a private motor vehicle, but because of the possibility of embolism he should not be permitted to operate a commercial or transportation vehicle.

Arrhythmias and Conduction Disturbances—Auricular premature beats are of little consequence and their presence does not preclude the operation of motor vehicles. However, any patient with paroxymal auricular tachycardia, flutter, or fibrillation should be evaluated carefully and when any of these findings is associated with myocardial insufficiency the patient should be advised not to operate a commercial or passenger transportation vehicle. If, however, these conditions are properly controlled the driver may operate some types of motor vehicles. Chronic auricular fibrillation should be the basis for preventing anyone from driving a commercial or passenger transportation vehicle.

Ventricular arrhythmias other than the occasional ventricular extrasystoles, are usually associated with serious heart disease and the possibility of sudden death. Such patients should not be permitted to drive. Persons with a marked degree of auricular-ventricular block or with Adams Stokes attacks should not be permitted to drive any motor vehicle.

Syphilitic Heart Disease—Patients with syphilitic aortitis, who might develop syncope, congestive heart failure, or angina pectoris, should not be permitted to operate a motor vehicle. In other types of syphilitc heart disease each patient must be evaluated by the physician before it can be determined whether he should be permitted to drive.

Diminished Cardiac Reserve—Patients with diminished cardiac reserve due to any type of heart disease may be permitted to drive a private vehicle but not a commercial vehicle or transportation vehicle. If the patient has congestive heart failure, he should not be permitted to drive any type of vehicle.

Summary

The importance of the physician in motor vehicle accident prevention is stressed. Heart disease may be an important factor in the etiology of motor vehicle accidents. Each cardiac driver must be individually evaluated by a physician to determine the likelihood that he can drive with safety. The role of the industrial physician has been presented. Specific recommendations are presented to assist the examining physician to evaluate the ability of a cardiac patient to drive with safety.

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Westinghouse Management Health Examinations—Their Investment Value

Harry B. Burr, A. B., Pittsburgh, Pennsylvania

DURING the past decade the periodic health examination more and more has come to be regarded as a most effective and economical technique of applying present knowledge to the prevention of disabling disease. Reasons for this lie in the many discoveries of incipient disease which it brings about, the increasing cost of medical care, the increased obligation of industry for employee disability benefits, and a wider recognition of the ability of medicine to control progressive disease when discovered before it becomes disabling.

Background

In Westinghouse, periodic health examinations for management personnel and for employees engaged in potentially hazardous work have been sponsored by company locations for more than 20 years. However, with relatively few exceptions, examinations conducted prior to 1957 did not attempt comprehensive health evaluation and afforded only a limited expression of the value of periodic health appraisal. With the advent of the present management* health examination program in 1957 this was changed.

Beginning then, standards set for periodic management health examinations have sought broad-scale health observation with a view to improving the conservation of management health and the control of disability expense for both examinees and the company.

Findings obtained from 1957 management health examinations—the first year of experience under the revised examination program—were distinctly impressive. However, owing to variation in the manner in which findings were obtained and classified among the several physicians who conducted the examinations, results were not susceptible of consolidated statistical treatment.

For 1958, changes aimed at further standardizing examination methods and reporting were made. These included (1) introducing general criteria for defining disease states to be classified as "significant"; (2) establishing a standard method for classifying significant findings, viz., the American Medical Association's "Standard Nomenclature of Diseases and Operations"; and (3) using a standard report form. With these changes, a number of major obstacles to reviewing and appraising examination results were removed.

Statistical Format—In developing Westinghouse examination statistics, results from limited examination programs are summarized separately from, as well as jointly with, those obtained through standard examination programs. By separating the results of limited programs from those of standard programs, the latter were freed from bias due to known limitation in examination scope. While this did not preclude the existence of bias from other sources, comparison of 1958 Westinghouse standard examination results with published results of similar examinations elsewhere shows numerous similarities.

Examination Procedures and Protocol—Standard medical procedures for Westinghouse management examinations in 1958 comprised (1) history, using self-supplied history as basis for traditional history development by examiner; (2) complete physical examination, including proctosigmoidoscopy; (3) blood studies, consisting of determinations of sedimentation rate and hemoglobin percentage, blood smear examination, serologic test for syphilis (in first examination only) and blood sugar level determination; (4) urine analysis, consisting of

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*As used here and hereafter the word "management" refers to all Westinghouse management employees except elected officers, division managers, and others designated as "top management," for whom there is a separate periodic health examination program.

tests for glycosuria and albuminuria with microscopy of centrifuged sediment to be performed if albumin is present; (5) electrocardiography; and (6) chest x-ray film. Examinations which include all of the foregoing procedures are designated "standard examinations." Those which do not include one or more of the listed procedures are labeled "limited."

Considerations in standard examination protocol were (1) that the examiner be a physician well qualified in diagnostic medicine and (2) that the examiner devote such time to examinations and to the review of findings as would preclude the chance that presence of any significant disease within the scope of the examination could go undetected. In 1958, examinations meeting corporate standards were performed largely by physicians specialized in internal medicine. The time generally required for the physical examination and the laboratory procedures was three to four hours per examinee.

"Significant Disease" Criteria—In addition to examination scope, a major determinant of significant disease prevalence is the definition of the term "significant." There are no generally recognized criteria for defining the term "significant," and had none been established for Westinghouse examinations, results would be subject to variation depending upon each examiner's conception of what disease is important. To the extent that such variation occurred, findings would present an indissociable mixture of examiner and examinee characteristics and impair the object of determining the latter alone. To reduce this type of complication as much as possible, there were introduced for 1958 company management examinations general criteria defining what disease should be considered significant and be included in calculations of disease prevalence among examinees. These criteria are expressed in the following statement:

> "Significant Disease" includes any condition which, if future medical care were not to be present, would be expected to cause any of the following:
>
> (1) Substantial medical and/or hospitalization expense.
> (2) Excessive sickness absence from work.
> (3) Death or major impairment of physical and/or mental capacity prior to age 65.

1958 Examinees—Members of Westinghouse management, including foremen, are eligible to participate in company management health examinations in any given year to the extent that each individual's participation does not exceed the corporate standard frequency of participation for his age and when his participation is authorized by his location manager. The corporate standard frequencies for management examinations are: persons over 50, every year; for those 40 through 49, every two years; and for those under 40, every three years.

With 1958 having been the second year for the new examination program, examinees at four locations which sponsored the new examinations for the second time included larger proportions of persons 50 and over than were present in their management populations. This is noted because the yield of significant disease findings for examinees 50 and over is higher than for those under 50 and all statements of 1958 results which include findings from "second-examination" locations will reflect a prevalence of disease somewhat higher than that which obtains for the total management population of the locations represented. Westinghouse management examinees in 1958 were all men at ages ranging from 30 to 65 with approximately one-third being in each of the three age groups given above.

Results

Participation—Management health examination programs for 1958 were reported by 24 Westinghouse locations which offered examinations to a total of 1,564 male management employees. Of the 1,564 eligible for examination, 1,458, or 93%, accepted the offer and were examined. In all instances the offers made employee acceptance of examination voluntary and provided that findings for the individual examinee would not be disclosed by the examiner to persons other than the examinee without the examinee's permission.

Each location was free to determine the extent, if any, to which examinations would be conducted on its premises and, in the case of locations having regular medical personnel, whether such personnel would be utilized in making examinations. The result was that 4 locations elected to conduct all or part of their examinations on company premises with regular medical personnel while the remaining 20 locations utilized outside medical personnel and facilities exclusively.

In the four locations conducting some or all of the examination inside, 786, or 97% of the 807 persons who were offered the examination, participated. In locations conducting outside examinations, 672, or 89% of the 757 invitees, were examined. From this, it appears that inside examinations need not present any great deterrent to examination and may, from the standpoint of convenience, provide an inducement to participate. However, unless inside examination can provide the full complement

of standard examination procedures, its deficiencies are likely to outweigh by far its advantages in convenience. In the 1958 experience, three of the locations conducting inside programs provided limited examinations.

Examinee Disease Prevalence—Over-all results of 1958 Westinghouse management health examinations, including both standard and limited examinations, show that among the group of 1,458 men for whom examination experience was reported, 550, or 38%, had significant disease findings. This rate of disease-finding was relatively low, owing to the fact that 872, or 60%, of these examinees received examinations of a scope less than that recommended in corporate management health examination standards. In these limited examinations, only 23% of examinees had significant findings. In contrast, *of the 586 examinees who participated in standard examination programs, 393 or 67% were found to have significant disease.** Similar contrast is afforded by the disease prevalence figures of other management examination programs shown in Table I.

*The 67% disease prevalence rate in standard examinations is not held to be representative of the management population from which it was drawn, since the proportion of men over 50 among examinees was larger than their proportion in the management population involved. With the greater prevalence of disease in older examinees, this circumstance was calculated to have increased the disease prevalence rate among men receiving standard examinations by 7 percentage points. Accordingly, the representative proportion of men with significant disease, as determined by Westinghouse standard examinations, is seen to be 60%.

Table I—How Healthy Are Executives?[1]

Findings	Reporting Authority
92.6% have some disease	Thompson and Staack
82.2% have "significant disorders"	Lutz
49.5% have "major disorders"	Franco
52.0% have defects needing treatment	Mallery

Significant Disease Findings — Altogether there were 1,259 findings of significant disease in the 1,458 examinees—an average of 0.86 finding per examinee, or 2.3 findings per individual having significant disease. To these findings limited examinations contributed at a rate of only 0.53 finding per examinee, whereas standard examinations produced 1.35 such findings—a rate 2.55 times as great.

Analysis of combined 1958 disease findings by disease category and type of examination is shown in Table II. From this it may be seen that among the several body systems the most frequent findings occurred in the cardiovascular and digestive systems. Significant cardiovascular findings occurred in 249 instances and accounted for 19.8% of the total findings. Significant digestive system disease was found in 197 instances and represented 15.6% of total findings. Together, findings in the two categories occurred 446 times and accounted for 35.4% of all findings.

Table II—Significant Findings by Disease Category and Type of Examination

(Ranked by Number of Findings in Major Categories of Combined Examinations)

	Combined Examinations (1,458) Significant Findings (1,259)			Standard Examinations (586) Significant Findings (796)			Limited Examinations (872) Significant Findings (463)		
Disease Category	No.	% of All Findings	% of Exams	No.	% of All Findings	% of Exams	No.	% of All Findings	% of Exams
Cardiovascular	249	19.8	17.1	131	16.5	22.4	118	25.5	13.5
Hypertension*	95	7.5	6.5	47	6.0	8.0	48	10.4	5.5
Heart disease	98	7.8	6.7	56	7.0	9.6	42	9.1	4.8
Digestive	197	15.6	13.5	170	21.4	29.0	27	5.8	3.1
Ulcer(s)	43	3.4	2.9	39	5.0	6.7	4	0.9	0.5
Neoplasm(s)	32	2.5	2.2	31	4.0	5.3	1	0.2	0.1
Body as a whole	194	15.4	13.3	78	9.8	13.3	116	25.1	13.3
Anxiety-tension	46	3.7	3.2	25	3.0	4.3	21	4.5	2.4
Sense organs	144	11.4	9.9	71	8.9	12.1	73	15.8	8.4
Vision	67	5.3	4.6	38	5.0	6.5	29	6.3	3.3
Respiratory	125	9.9	8.6	86	10.8	14.7	39	8.4	4.5
Lung	65	5.2	4.5	44	6.0	7.5	21	4.5	2.4
Musculoskeletal	104	8.3	7.1	58	7.3	9.9	46	9.9	5.3
Rheumatoid	9	0.7	0.6	4	1.0	0.7	5	1.1	0.6
Genitourinary	84	6.7	5.8	64	8.0	10.9	20	4.3	2.3
Integumentary	69	5.5	4.7	60	7.5	10.2	9	1.9	1.0
Endocrine	44	3.5	3.0	36	4.5	6.1	8	1.7	0.9
Diabetes	33	2.6	2.3	29	4.0	4.9	4	0.9	0.5
Hemic-lymphatic	35	2.8	2.4	31	3.9	5.3	4	0.9	0.5
Anemia	7	0.6	0.5	6	1.0	1.0	1	0.2	0.1
Nervous	14	1.1	1.0	11	1.4	1.9	3	0.6	0.3
Total	1,259	100.0	86.4	796	100.0	135.4	463	100.0	53.1

*Not affecting heart

The high proportion of cardiovascular findings in the combined examination results was due to the relatively great proportion of such findings in both standard and limited examinations.

In contrast, the high proportion of digestive system findings was due predominantly to standard examinations which afforded more complete observation of the gastrointestinal tract than did limited examinations. Of the 197 significant digestive system disorders reported in the combined examinations, 170, or 86%, were found in standard examinations.

Almost as frequent as significant findings in the cardiovascular and digestive systems were those classified under "Body as a Whole." In this group were included psychological conditions and diseases involving more than one body system exclusively. Because of the varied nature of findings classified in this section, the total of such findings is of relatively little importance in analyzing disease prevalence. However, as regards significant psychological problems, the breakdown shows that of the 194 findings reported in this section, 46, or 24%, representing 3.2% of total examinees, involved such problems at the time of examination.

The rate of disease-finding was greater among standard examinations than among limited examinations in every disease category studied except "Body as a Whole," for which the rates of finding in the two types of examination were equal. This superiority of standard examinations was due to more than the greater number of diagnostic procedures which they comprised, since in some diagnostic areas the scope and number of procedures in standard programs were no greater than in limited programs. Accordingly, part of the credit for the superiority of standard examinations in detecting disease must go to physician performance. In this, standard examinations outweighed limited examinations in the use of physician time and in the use of examiners specially trained and experienced in diagnostic medicine.

Major Disease Findings—Since criteria defining significant disease for 1958 management examinations limited such disease to that imposing or threatening substantial adverse effects upon company and employee welfare, all reported 1958 examination findings should be regarded as having more than passing importance. At the same time, it can be recognized that among the array of 1958 findings, the adverse effect or implication of some findings was much greater than that of others. Findings having this greater adverse significance are characterized hereafter as major.

Table III—Major Findings by Type of Examination and Disease Category

(Ranked by Number of Findings in Combined Examinations)

Disease	Combined Examinations (1,458) Major Findings (301)			Standard Examinations (586) Major Findings (202)			Limited Examinations (872) Major Findings (99)		
	No.	% of All Findings	% of Exams	No.	% of All Findings	% of Exams	No.	% of All Findings	% of Exams
Heart disease	98	7.8	6.7	56	7.1	9.6	42	9.1	4.8
Hypertension (not affecting heart)	95	7.5	6.5	47	5.9	8.0	48	10.4	5.5
Peptic ulcer	43	3.4	2.9	39*	4.9	6.7	4	0.9	0.5
Diabetes	33	2.5	2.3	29	3.6	4.9	4	0.9	0.5
Digestive system neoplasm(s) †	32	2.6	2.2	31‡	3.9	5.3	1	0.2	0.1
Total	301	23.9	20.6	202	25.4	34.5	99	21.4	11.4

*Of these 39 cases of peptic ulcer, 31 or 79% were found in a population of 152 examinees by procedures additional to those recommended in Corporate examination standards. These procedures consisted in a conventional series of x-ray films of the upper gastro-intestinal tract plus cineroentgenograms of such tract for each of the 152 examinees involved. Had such procedures not been used, the expected findings, based on a projection of results from the 434 standard examinations which did not include such procedures to all 586 standard examinations, would have been:

Disease	Standard Examinations		
	Number Findings	% of All Findings	% of Examinations
Peptic ulcer, standard examinations	11	1.4	1.9

†All 1958 findings in this category were rectal growths (largely polyps). Of those removed and biopsied, one polyp was found to be cancerous and three polyps were classified as being precancerous (as distinct from simply benign).

‡This result was obtained with sigmoidoscopy (the principal procedure for detecting rectal polyps) having been omitted in 63 examinations. Had sigmoidoscopy been performed in all standard examinations, the expected findings based on a projection of results from the 523 sigmoidoscopic examinations performed to all 586 standard examinations, would have been:

Disease	Standard Examinations		
	Number Findings	% of All Findings	% of Examinations
Digestive system neoplasm(s), standard exams	35	4.4	6.0

Major disease identified in 1958 Westinghouse management examinations existed largely in the 301 findings reported in the heart disease, hypertension, peptic ulcer, diabetes, and digestive system neoplasm* categories. Analysis of these findings by type of examination and disease category is provided in Table III, which shows that conditions reported in the five major disease categories were found at a rate of 20.6 times per hundred combined examinations and accounted for 23.9% of all findings. Again, the combined examination yield was due largely to standard examination experience. Whereas limited examinations produced major disease findings only 11.4 times per hundred examinations, standard programs found 34.5 major conditions per hundred examinations—a rate 3 times that for limited examinations. Thus, in the area of major disease, the superiority of standard examinations over limited examinations was even greater than among total findings, in which the yield from standard examinations was but 2.55 times that of limited examinations.

Of the 301 major disease findings 98, or 33%, were for heart disease; 95, or 32%, were for hypertension; 43, or 14%, were for peptic ulcer; 33, or 11%, were for diabetes, and 32, or 11%, were for lower bowel growths (digestive system neoplasms). In each of these individual disease categories, as in total major disease findings, the rate of finding was substantially greater in standard examination programs than in limited programs. For heart disease, the rate of finding per hundred examinations in standard programs (9.6) was twice that in limited programs (4.8); for hypertension, the standard program rate (8.0) was one and one-half times that in limited programs; for peptic ulcer, standard program rate (6.7) was over seven times that in limited program (0.5); for diabetes, the standard program rate (4.9) was almost 10 times that for limited programs (0.5), and for rectal growths, the standard program rate (5.3) was over 50 times that for limited programs (0.1).

Explanation for the finding of diabetes and rectal growths much more frequently in standard examinations than in limited examinations exists largely in the fact that two procedures regularly employed in standard examinations were omitted in limited examinations. Respectively, these were (1) determination of fasting blood sugar level and (2) observation of the lower bowel with the sigmoidoscope. The greater prevalence of heart disease findings in standard examinations is attributed in part to the difference between standard and limited examination programs in the degree to which electrocardiography was employed. In standard examinations, electrocardiograms were made routinely; in limited examinations, they sometimes were omitted.

The finding of peptic ulcer much more frequently in standard examinations than in limited examinations was due mostly to the use of diagnostic x-ray procedures in a series of 152 examinees included in the standard examination group. Such x-ray procedures were performed routinely for the 152 examinees and included in each instance both a conventional series of x-ray films of the upper gastrointestinal tract and motion picture films of x-ray images of the tract (cineroentgenograms). Of the 43 cases of peptic ulcer identified in the combined examinations, 31, or 72%, were detected in these 152 examinees. Within the group of 152, the 31 findings of peptic ulcer represent a prevalence of 20.4%. In a series of 500 executive examinations at the University of Michigan[2] which routinely employed only the conventional sequence of x-ray films of the upper gastrointestinal tract the prevalence of peptic ulcer was found to be but 6%. Some of the difference between these two prevalence rates is attributed to the use of the motion picture studies employed in the Westinghouse program. These films identified some peptic ulcers, mostly small, which were not visible in the conventional film series and which otherwise would not have been detected. However, the largest part of the difference is attributed to other factors, two such being an older average age in the Westinghouse examinees involved and a competition for findings among the several radiologists who made comparative interpretations of the Westinghouse films.

Diagnostic x-ray studies of the upper gastrointestinal tract were not included among the procedures recommended in 1958 corporate management examination standards, and their use in the one group of 152 examinees was for research purposes. Had they not been employed at all, the prevalence of peptic ulcer detected in combined 1958 examinations—based on a projection of results from examinations in which such procedures were not used—would have been only 1%, or about one-third the 2.9% actually observed. Among standard examinations, the corresponding prevalence would have been but 1.9% instead of the 6.7% actually observed.

Comparison of major disease prevalence figures obtained from 1958 Westinghouse manage-

*All 1958 findings in this category were growths in the lower bowel (largely polyps). Of those removed and biopsied, one polyp was found to be cancerous and three polyps were classified as being precancerous (as distinct from simply benign).

ment examinations with corresponding figures from other executive examination programs is provided in Table IV.

Table IV—Comparative Prevalence of Major Disease in Examinees: Westinghouse vs. Other Executive Examination Programs
(Ranked by Percentage in Combined Westinghouse Examinations)

Disease	Percentage of Examinees Having the Diseases Indicated				
	Westinghouse			Bolt, Tupper, and Mallery[2]	General Experience, Roberts[3]
	Combined Exams	Standard Exams	Limited Exams		
Number examinee(s)	1,458	586	872	500	
	%	%	%	%	%
Heart disease	6.7	9.6	4.8	6.4	5-20*
Hypertension not affecting heart	6.5	8.0	5.5	9.0†	5-20‡
Peptic ulcer	2.9§	6.7§	0.5	6.0	5-10
Diabetes	2.3	4.9	0.5	2.0	1-3
Rectal polyps	2.2	5.3	0.1	4.0	5-15

*Arteriosclerotic heart disease only.
†Calculated from data given by the authors.
‡Includes all hypertensive disease.
§Rate is predominantly the result of diagnostic x-ray procedures carried out on only 152 examinees. Such procedures included both conventional x-ray films and cineroentgenograms of the upper gastrointestinal tract. The prevalence of peptic ulcer among the group of 152 men as determined with these procedures was 20.4%.

Original Discovery of Disease—One of the most valuable contributions of periodic health appraisal is the discovery of significant disease which previously has not been known or defined. Such discovery is a basic step upon which effective treatment of disease necessarily must depend. Accordingly, it is important to note that original discovery of disease was frequent in 1958 Westinghouse management health examinations.

As shown in Table V there were 533 original discoveries of disease. These were 42% of the entire 1,259 findings in the combined examinations. Among these new discoveries 146, or 12% of the total findings, were new discoveries of major disease. Most impressive were the new discoveries of disease which occurred in the absence of symptoms—discoveries commonly offering the earliest and best opportunities for treatment. Of the 533 new find-

Table V—Original Findings of Significant Disease by Disease Category, Type of Examination, and Absence of Symptoms
(Ranked by Number of Findings in Major Categories of Combined Examinations)

Disease Category	Combined Examinations (1,458)* Original Disease Findings				Standard Examinations (586) Original Disease Findings				Limited Examinations (872)* Original Disease Findings			
	Total		No Symptoms		Total		No Symptoms		Total		No Symptoms	
	No.	% of Exams	No.	% of Exams	No.	% of Exams	No.	% of Exams	No.	% of Exams	No.	% of Exams
Cardiovascular	110	7.5	98	6.7	50	8.5	38	6.5	60	6.9	60	6.9
Hypertension	45	3.1	43	2.9	19	3.2	17	2.9	26	3.0	26	3.0
Heart disease	31	2.1	23	1.6	19	3.2	11	1.9	12	1.4	12	1.4
Digestive	94	6.4	58	4.0	87	14.8	54	9.2	7	0.8	4	0.4
Ulcer(s)	21	1.4	11	0.8	21	3.6	11	1.9	0	0.0	0	0.0
Neoplasm(s)	31	2.1	30	2.1	30	5.1	29	4.9	1	0.1	1	0.1
Body as a whole	89	6.1	79	5.4	22	3.8	12	2.0	67	7.7	67	7.7
Anxiety-tension	13	0.9	4	0.3	9	1.5	0	0.0	4	0.4	4	0.4
Respiratory	57	3.9	44	3.0	30	5.1	21	3.6	27	3.1	23	2.6
Lung	38	2.6	30	2.1	24	4.1	18	3.1	14	1.7	12	1.4
Genitourinary	45	3.1	27	1.9	34	5.8	20	3.4	11	1.2	7	0.8
Sense organs	39	2.7	27	1.9	21	3.6	15	2.6	18	2.1	12	1.4
Vision	22	1.5	14	1.0	11	1.9	9	1.5	11	1.2	5	0.6
Misculoskeletal	32	2.2	22	1.5	16	2.7	6	1.0	16	1.8	16	1.8
Rheumatoid	2	0.1	2	0.1	1	0.2	1	0.2	1	0.1	1	0.1
Hemic-lymphatic	25	1.7	25	1.7	23	3.9	23	3.9	2	0.3	2	0.3
Anemia	3	0.2	3	0.2	3	0.5	3	0.5	0	0.0	0	0.0
Endocrine	24	1.6	23	1.6	18	3.1	17	2.9	6	0.7	6	0.7
Diabetes	18	1.2	17	1.2	17	2.9	16	2.7	1	0.1	1	0.1
Integumentary	15	1.0	10	0.7	14	2.4	9	1.5	1	0.1	1	0.1
Nervous	3	0.2	1	0.1	3	0.5	1	0.2	0	0.0	0	0.0
Total	533	36.6	413	28.3	318	54.3	216	36.9	215	24.7	197	22.6

*Among limited examinations, 75, or 16% of the 463 findings, were unclassified in respect to original discovery of disease. Of these 75 findings, 35 were assigned as new findings of disease and distributed among the classifications shown on the basis of known distribution among the 84% of limited examination findings which were classified in respect to original discovery of disease.

ings, 413, or 33% of the entire 1,259 findings, were unaccompanied by symptoms. Again, a substantial proportion involved major disease. Of the 413 new findings not associated with symptoms, 124, or 10% of the total findings, were for asymptomatic major disease.

Expressed in other terms, the foregoing results show that of the 42% of total findings representing original discovery of disease, 27% involved major disease, while 78% of all new discoveries of disease and 85% of new discoveries of major disease occurred in the absence of symptoms. These observations all relate to experience in the combined 1958 examinations. However, they are not greatly different for standard examinations or for limited examinations. To be noted, though, is the fact that while limited examinations produced new discoveries of disease at a rate of only 24.7 times per hundred examinations, the rate for standard examinations was 54.3—a figure 2.2 times as great. Thus, despite the similarity in the way the two types of examination distributed findings among the several kinds of new discoveries of disease, the frequency of such discoveries was much greater in standard examinations than in limited examinations.

On the whole, these 1958 Westinghouse results compare quite closely with published results from other studies of executive examinations (albeit more so for standard examinations than for combined or limited examinations). Figures given by Bolt, Tupper, and Mallery[2] show that upon initial examination 35% of all findings represent new discovery of disease. Elsom, Spoont, and Potter[1] have observed that almost 70% of examinees with newly discovered disease had no symptoms attributable to the disease found.

It should be recognized that the present discussion of prevalence rates for new discovery of disease relates only to the initial examination of applicants. Depending upon frequency of examination, the prevalence of new findings in subsequent examinations of the same applicants will be lower. Bolt and his associates[2] found that on subsequent examinations of the same executives at yearly intervals from 12.7% to 20.3% had new abnormalities requiring treatment. Elsom and his associates[1] found that 22% of examinees developed significant new disease in the one- to two-year interval following initial examination. However, in both of these studies, the results given were for an examinee population spanning several age groups. Had only the older examinees been reexamined after the intervals specified, as in the Westinghouse program, it would be expected that the yield of findings would have been considerably higher. This is because in addition to the increase in disease prevalence with age, there is an increase with age in disease incidence—its rate of occurrence per unit of time.

The Need and Prospect for Medical Care—Almost two-thirds of the 1958 findings were subject to benefit from future medical care. Of 1,227 findings so appraised by examiners, 805, or 66%, were such as could benefit from future medical attention. Within this result, the proportions able to benefit in the standard and limited examination groups were essentially the same. Table VI shows the proportion of disease findings subject to benefit from future medical care in each of the disease categories studied.

Of singular importance was the proportion of major disease findings which could be favorably influenced by future care. As compared with the 66% of over-all findings which were subject to benefit from future medical attention, 83% of major disease findings in the combined examinations were judged by examiners as being able to benefit from future care. In the standard examination experience, 87% of major disease findings were seen as susceptible of benefit from future care.

To a large extent, the significance of these results depends upon how frequently those who

Table VI—Proportion of Findings Subject to Benefit from Future Medical Care by Disease Categories

Disease Category	Combined Examinations %	Standard Examinations %	Limited Examinations %
Cardiovascular	72	73	69
Hypertension*	85	81	90
Heart disease	70	82	47
Digestive	71	73	59
Ulcer(s)	93	97	50
Neoplasm(s)	100	100	100
Body as a whole	75	78	72
Anxiety-tension	63	68	57
Sense organs	51	52	49
Vision	76	61	97
Respiratory	52	53	47
Lung	52	55	44
Musculoskeletal	54	53	54
Rheumatoid	44	50	40
Genitourinary	57	47	90
Integumentary	65	68	44
Endocrine	82	78	100
Diabetes	82	79	100
Hemic-lymphatic	89	87	100
Anemia	86	83	100
Nervous	79	73	100
	66	66	64

*Not affecting heart

are advised to obtain medical care actually obtain it. On this score, relatively little has been published. However, in reviewing what has been learned on the subject, Roberts[3] notes two studies which show that 65% or more of examinees who were advised to obtain medical attention did receive it over a period of time. In one, a study by Whalen and Woodward, it was reported that 94 of 100 patients in whom a significant new diagnosis was made at the time of periodic examination sought and largely obtained medical attention within several months after the discovery. In the other instance, a study by Prickman and his associates, it was shown that, of 231 executives having at least two periodic health examinations at the Mayo Clinic and receiving medical and/or surgical advice, 65% complied fully. In this, it was noted that there was a slightly greater tendency for examinees to comply with advice given after a second or third examination than with that given after an initial visit.

Does the absence of symptoms seriously affect compliance with recommendations for medical care? This is an important question since, as previously indicated, the discovery of asymptomatic disease often provides the earliest and best opportunity for treatment. Unfortunately, knowledge on this point is not yet sufficient. Presumably, however, those with asymptomatic disease feel less urgency about seeking medical care and tend to forego it more frequently than do those with symptoms. Accordingly, obtaining compliance with recommendations for medical care in cases of asymptomatic disease may require more persuasion than is necessary when symptoms are present. In this regard, it appears helpful when a letter stressing the importance of obtaining indicated medical care is sent by the chief executive of an organization or organization unit sponsoring management examinations to each participant in the examinations.

Cost

Measurement of 1958 Westinghouse management health examination cost was made only in respect to charges for outside medical service with no attempt having been made to determine expense involved in company medical and administrative activity or in time spent by management employees in obtaining examination. For programs utilizing regular company medical services this meant that no comprehensive record of examination expense was kept. However, for programs in which examinations were performed separately from regular company medical services, the entire direct cost of performing the examinations was recorded. Accordingly, the following discussion of examination cost is limited to outside examination charges and deals mostly with examinations performed separately from regular company medical services.

Actual Costs—Altogether, outside charges reported for 1958 management health examinations amounted to $35,657.50. Of this total, $33,076.50, or 92%, applied to examinations performed separately from regular company medical services and $2,581, or 8%, applied to examinations in which regular company medical services also were involved. Of the $33,076.50 expended for examinations conducted separately from regular company medical services, $29,941.50, or 91%, related to standard examinations and $3,135, or 9%, went for limited examinations.

As for individual examination cost, that for standard examinations—all 586 of which were performed separately from regular company medical services—ranged from under $50 up through $75. The average cost of a standard examination was $51.09. For the 125 limited examinations performed entirely outside the company and for which cost was fully known, the amount ranged from $24 through $35—the average cost being $25.08.

Comparative Costs—Ultimately, the importance of periodic health examinations to industry is to be judged by their effect on company financial welfare. Therefore, it is of interest to compare the cost of periodic examinations with the dollar influence of their results on other company activity.

Because of the crucial nature of this interest, it is particularly unfortunate that most of the effects of health examinations on industrial activity do not lend themselves to effective measurement. Since health examinations deal with factors affecting the performance of people, there is probably no aspect of industrial activity which, in one way or another, they do not involve. However, human performance involves such a complex of variables that, thus far, attempts to disentangle the elements of causation attributable to health care and to measure their effect on job performance largely have been thwarted. Accordingly, little can be offered comparing the cost of periodic health examinations and their dollar influence on employee output.

Despite this difficulty, there remains one segment of industrial economics in which part of the over-all effect of periodic health examinations may be discerned and within which examination cost may be compared with the actual or projected dollar influence of exami-

nation results. Moreover, depending upon individual company circumstances, the outcome of comparison in this one area alone may support the performance of periodic health examinations not only for management employees but for other employees as well.

The area in question is that comprised in individual company expenditures for employee disability benefits. Chiefly, it involves sickness and death benefits arising from nonoccupational illness and is reflected in company payments for employee social insurance and for extending wages and/or salaries to employees during periods of disability absence. For many companies, the amount involved in these payments has increased enormously in the past few years and has become a major business expense.

Although important in actual amount, only a small part of this increased company cost of employee disability has been due to price inflation. By far the largest part of the increase has come about through collective bargaining agreements broadening company sponsorship of employee life and health insurance coverages. Commonly, this broadening has occurred in two ways: first, by extension of the limits of insurance coverage for employees, including particularly, the addition of major-medical or catastrophic illness protection; second, by increases in the proportion of employee insurance premiums paid by the company. The addition of major-medical coverage—above and beyond conventional hospitalization, medical and surgical insurance—frequently has increased disability insurance coverage for the individual employee by $10,000 or more. And when this and other increases in employee insurance coverage have been combined with an increase in the proportion of insurance premium paid by employers, as has often happened, the effect has been to compound the increase in company costs for employee insurance. In this connection, it is of interest to note that a great many employers now pay 100% of employee insurance premiums.

In 1950, there were but a handful of companies which provided major-medical protection for employee nonoccupational disability and paid 50% or more of the premium for such insurance. At the end of 1958, the number of such companies had risen enormously and included an estimated total of some 7,400* firms which paid the entire cost of the coverage. With this development and the increasing liberalization of extended-pay policies for employees experiencing disability, *company costs for employee nonoccupational disability, which previously were only two or three times the cost of employee occupational disability, have risen in some instances to over ten times the occupational disability cost.*

For Westinghouse and other companies which have assumed these greatly increased obligations for employee disability benefits, the opportunity to achieve substantial net gains with periodic health examinations and other preventive medical services has been greatly enlarged. An excellent example exists in the 1958 Westinghouse management examination experience.

Considering only four cases in which cancerous or precancerous rectal polyps were found and removed, prospective company savings may more than cover the cost of the entire 1958 management examination program. According to the American Cancer Society,[5] 77% of persons with rectal cancer discovered and treated in an early stage are surviving five years or more, whereas only 25% of those with rectal cancer now survive five years. From these figures, at least two men have been saved from death due to rectal cancer for a period of five years and, perhaps, entirely. Almost certainly, this lifesaving may be attributed to company examinations, since, in the absence of such examinations, the chance for early discovery as a result of symptoms or in a non-company-survey examination would have been relatively low.

Characteristically, symptoms calling attention to rectal cancer do not appear until the cancer has reached an advanced stage, and early discovery by means other than periodic examination occurs only infrequently as a coincidence of the investigation of other disease. As for discovery in a non-company-survey examination, the difference between the above-mentioned survival rates suggests how infrequently such examinations occur.

Under Westinghouse programs for employee insurance and disability salary extension, the company saving for the avoidance of major disability and death in a representative 1958 management examinee could amount—and might well amount—to more than $30,000, exclusive of any saving of underwriting charges which might accompany reduced loss experi-

*The "Life Insurance Fact Book—1959"[6] reports there were 27,310 master policies of group social insurance affording major-medical protection in force at the end of 1958. Allowing that 25% of these policies did not apply to separate employers, the number of individual companies represented would be approximately 20,500. Of these 20,500 companies, the proportion paying the entire cost of the policies, based on a 1959 survey by the National Industrial Conference Board,[7] is taken to be 36% or about 7,400.

ence. Thus, from only four findings the company may well save over $60,000 in employee benefit costs—over twice the $30,000 which was expended for standard examinations which produced these findings. For limited examinations, which did not include examination of the lower bowel with the sigmoidoscope, prospective gain from rectal cancer findings was virtually precluded.

Among the remaining 27 cases of rectal growths discovered in the examinations, there may have been other cancers, since not all growths were removed and subjected to biopsy to determine whether cancer was present. However, even assuming that all 27 cases were benign, it would be expected on the basis of general medical experience that 5 would become malignant over a period of time in the absence of detection and treatment. Allowing that only four of the five will secure early treatment and that only three will be "saved" (as compared to the one who would be expected to survive without early detection and treatment) an additional company saving of over $60,000 may well occur. Again, the prospective saving is related entirely to sigmoidoscopy in standard examinations.

In calculating these prospective savings from the early discovery of asymptomatic rectal growths, it should be observed that the number of such growths found in 1958 Westinghouse standard examinations was not atypical. As was indicated previously, in comparison with asymptomatic rectal polyp prevalence rates of 4% found by Bolt et al.[2] and 8.5% given as representative by Roberts,[3] the Westinghouse standard examination rate was 5.3%. In addition, it is to be noted that, as a factor in calculating savings, the cost of removing the rectal growths in question is negligible.

Both of the foregoing illustrations of prospective company gain arising through periodic examinations have reflected savings in life insurance expense. However, this does not imply that a net gain from periodic examinations depends upon lifesaving. On the contrary, the circumstances are such that net gain can result quite readily from savings in salary extension and/or sickness insurance expense alone. For example, the total cost of the 1958 Westinghouse examinations represented no more expense than extending salaries during disability to the examinees involved for only about one work day. In other words, were the 1958 examinations to be credited with an average saving of only about one day of disability absence per man involved during all of the examinees' entire remaining years with the company—a period of more than 15 years remains between the group average age and normal retirement age—the cost of the program would be repaid. Counting the time required for the men to receive the examination, the saving in disability absence over the years would need to be but a day and a half each.

From these comparisons alone, it would appear that company savings attributable to 1958 management examinations may well amount to over four times the cost of the examinations. Of this prospective return, by far the largest share is attributed to findings obtained in standard examinations.

Since the 1958 examinations were predominantly initial examinations under the company's revised management examination program, new discoveries of disease were more frequent than is expected to be the case with re-examinations. However, there is nothing to suggest that the return on investment in subsequent examinations will be less than that just indicated; particularly with examination frequency varying with age as described earlier. Again, it should be noted that in saying investment return "may well amount to over four times the cost of the examinations," the observation was drawn from only thirty-one findings —less than 3% of the total 1958 findings.

Summary

A comprehensive analysis of 1958 Westinghouse management health examination experience reveals the following principal points.

Results

Participation—Management health examination programs for 1958 were reported by 24 Westinghouse locations which offered examinations to a total of 1,564 male management employees at ages from 30 through 65. Of the 1,564, a total of 1,458, or 93%, accepted the offer and were examined. Participation at locations offering examinations inside the company was 97%, indicating that inside examination offers no great deterrent to participation. Predominantly, the examinations represented initial examinations under the revised Westinghouse management health examination program.

Examinee Disease Prevalence—Over-all results, including both examinations whose scope met corporate standards and those that did not, show that 550, or 44% of the 1,458 men examined, had significant disease findings. This rate of disease-finding was relatively low in comparison with results of some other pro-

grams and was due to the fact that in limited examinations only 23% of examinees had significant findings. In contrast, 67% of 586 examinees receiving standard examinations were found to have significant disease. The representative proportion of management employees with significant disease, as determined with the company's standard examination, was seen to be 60%.

Significant Disease Findings—Altogether, there were 1,259 findings of significant disease —an average of 0.86 finding per examinee. To these findings, limited examinations contributed at a rate of only 0.53 finding per examinee, whereas standard examinations produced 1.35 findings per examinee—a rate 2.55 times as great. Most frequent findings were those involving the heart and blood vessels, 19.8% of all findings, and the digestive system, 15.6% of total findings.

Major Disease Findings—Of the 1,259 significant disease findings in the examinations, 301, or 23.9%, were regarded as major in the degree to which they imposed or threatened adverse effects upon company and employee welfare. These were findings of heart disease, hypertension, peptic ulcer, diabetes, and rectal growths. Limited programs contributed major findings at a rate of 11.4 findings per hundred examinations. Standard examinations contributed such findings at a rate of 34.5 per hundred examinations, or three times the rate for limited examinations.

Original Discovery of Disease—Original discovery of disease in the examinations was frequent. All told, 533, or 42%, of the 1,259 significant findings in the examinations were original findings. Of the 533 new findings, 146, or 12% of total findings, were for major disease. Most impressive were the new discoveries which occurred in the absence of symptoms, discoveries commonly offering the earliest and best opportunities for treatment. Of the 533 new findings, 413, or 33% of the total findings, were unaccompanied by symptoms. Of these 413 findings, 124 were original discoveries of major disease unaccompanied by symptoms. Expressed in other terms, the foregoing results show that, of the 42% of total findings representing original discovery of disease, 27% involved major disease, while 78% of all new discoveries of disease and 85% of new discoveries of major disease occurred in the absence of symptoms. On the whole, these results compare closely with corresponding results from other studies of executive examinations.

The Need and Prospect for Medical Care—Almost two-thirds (66%) of the disease conditions found in 1958 examinations were judged by examiners as subject to benefit from future medical care. Among major disease conditions, 83% were seen as able to benefit from future attention. The degree to which future care will be obtained in cases for which it was indicated is unknown. However, at least two studies have shown that 65% or more of examinees advised to obtain future medical care did obtain it. In this, the presence of symptoms probably plays a part and obtaining compliance with recommendations for care in cases of asymptomatic disease may require more persuasion than when symptoms are present.

Cost

Measurement of examination cost was limited to outside charges for examination services. For standard examinations this included the full direct cost of all 586 such examinations. For limited examinations, it included both charges for examinations involving company medical services as well as those for 125 examinations in which the entire examination was performed separately from regular company medical services.

Actual Costs—Outside medical charges amounted to $35,657.50. Of this, $33,076.50 related to the complete performance of examinations—$29,941.50 for 586 standard examinations and $3,135 for 125 limited examinations. The cost of individual standard examinations, all performed separately from company medical services, ranged from under $50 up to $75 and averaged $51.09. The cost of individual limited examinations performed entirely outside the company ranged from $24 through $35 and averaged $25.08.

Comparative Costs—Comparing the cost of the 1958 examinations with just their effect on Westinghouse employee insurance and disability salary extension expense shows the prospect of important net gain to the company. From only 31 findings of early rectal growths—less than 3% of the total examination findings—prospective company savings from the avoidance of cancer are over $120,000—more than four times the cost of the entire standard examination program which produced the findings. Stated in other terms, were the 1958 Westinghouse management examinations to be credited with an average saving of only about one day of disability absence for the men involved during all of their entire remaining year with the company, the entire cost of the examinations would be repaid. Counting the time required for the men to receive the ex-

amination, the saving in disability absence over the years would need to be but 1½ days each. For the future, there is nothing to suggest that the return on investment in subsequent examinations will be less than that in prospect for the 1958 examinations, particularly with examination frequency varying with age as under the present management examination program.

Conclusion

For Westinghouse and many other companies, comprehensive periodic management health examinations offer an important investment opportunity. In addition to returns in management morale—which, in themselves, may far outweigh examination cost—such examinations make for great savings in company expenditures for employee disability benefits. When employee group life insurance, hospitalization and surgical insurance, sickness and accident insurance, major-medical insurance, disability salary extension, and workmen's compensation expenses are borne entirely by the company, broad-scale management health examinations offer prospective savings in employee disability benefits of four times or more the cost of the examinations. Under these circumstances, progressive managements readily will recognize that comprehensive periodic health examinations have the attributes of a high-priority objective—certainly for all management personnel; perhaps for other employees as well.

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Topical Review

Fluorides: A Critical Review

III. The Effects on Man of the Absorption of Fluoride

Frank Princi, M.D., Cincinnati, Ohio

THE ABSORPTION of the fluoride ion by man was noted before elemental fluorine was isolated. Early investigations of its physiological effects were casual and sporadic. More recently, however, greater attention has been devoted to the biological consequences of its absorption both by individual subjects and also by certain populations under relatively close observation.

Among the first descriptions of an injurious effect was that of Thénard and Gay-Lussac[1] in 1809, on the action of hydrofluoric acid on the skin. They noted the appearance of a "white spot" associated with pain, followed by the formation of a blister.

Fluoride was found in the dental enamel of man and animals in 1805 by Morichini.[2] In 1807 Berzelius[3] reported that human and ox bones contained calcium fluoride in varying concentrations. Other investigators[4, 5] made similar observations later, and in 1856 Nicklès[6] found fluoride in blood, urine and certain tissues. Horsford,[7] in 1869, demonstrated the presence of fluoride in brain tissue.

As other investigators reported their observations, it became evident that fluoride was present in all body tissues. The data of Zdarek,[8] for example, in 1910, were in confirmation of this fact. From them he concluded that liver, kidney, and bone contained the highest concentrations of fluoride, and half of that found in bone was present in the fatty portions. The use of improved analytical procedures confirmed the presence of fluoride in human dental enamel, in the London area of England, and revealed the order of magnitude of the concentration as 0.02%.[9] These analyses were done by the zirconium-alizarin method.

Recently, the urinary excretion of fluoride has undergone intense study, and reports of results obtained under a variety of conditions show no serious degree of disagreement among various authors. In 1936, Machle[10] (using a modification of the Willard and Winter analytical method) reported that the concentration of fluoride in the urine of persons in the United States who were not subjected to any unusual exposure to fluoride was in the range of 0.56 to 2.80 mg/liter. Brun and his colleagues[11] reported results of corresponding observations which ranged from 0.30 to 1.60 mg/liter and averaged 0.92 mg/liter. It should be noted, however, that the latter group of subjects was composed of hospitalized persons between the ages of 2 months and 76 years. Machle's[10] subjects, on the other hand, included many healthy persons, whose activities, including their dietary regimen, were unrestricted.

Many descriptions and discussions of fluoride intoxication have been written during the past three decades, but the most comprehensive was published by Roholm[12] in 1937. The characteristics of acute intoxication by fluoride compounds were described by him in great detail, and his descriptions are in general conformity with the observations of others. There has been no serious disagreement among various investigators concerning the effects induced by the absorption of a single toxic dose of a fluoride. The effects of the absorption of relatively small doses of fluoride daily or frequently over extended periods of time, on the other hand, are not reported with a similar degree of agreement or even similarity.

In common with other materials which, in concentrated form, are highly irritating, certain fluoride compounds (HF) will produce destructive lesions of marked severity.[1, 12-16] Certain other inorganic compounds of fluorine may also be quite irritating, and materials of this type, in sufficient concentration, will evoke violent responses from the organ system with which they first come into contact.

Since most cases of acute fluoride intoxication have resulted from the *ingestion* of large doses of fluoride compounds, the effects of these

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substances on the gastro-enteric tract have been described by many authors.[17-22] The severity of the symptoms is in direct proportion to the irritating properties and to the amount of the compound that has been ingested. Thus, vomiting may be clear or hemorrhagic, diffuse abdominal pains of a cramping type are usually present, and diarrhea is a common occurrence.

If the dose of the fluoride compound has been sufficiently large and absorption has been effective, central nervous system involvement can be expected.[12, 22, 23] Tonic and clonic convulsions may occur and may or may not persist. Twitching of muscle groups is not uncommon. Thirst, diaphoresis, and salivation have been reported commonly. Although some suggestion has been made[22] that fluoride compounds may produce a paralytic reaction, it seems most probable that the immediate effect of excessive absorption is one of intense stimulation of the central nervous system, with a resulting exhaustion of the nervous pathways. It is important to recognize that seemingly significant differences in the type or severity of the symptoms reported by various authors are associated with differences in the specific fluoride compounds to which the illnesses were attributed. Numerous authors[24-28] have reported their observations.

The effects of prolonged absorption of fluorides, as indicated above, are not so fully agreed upon. Since fluoride is retained preferentially in bone, the osseous structures have demanded the attention of almost all of those who have investigated situations involving prolonged exposure to fluoride. Brailsford[29] has given what is perhaps the clearest and most understandable description of the osteosclerosis that is seen in the roentgenogram following the long-continued absorption of sufficient amounts of fluoride. Since there are no serious differences of opinion concerning this description, and even those who are in sharp disagreement on other aspects of the subject agree on the characterization of this condition, his description is reported verbatim:

> In fluorosis of bone, the first signs are more apparent in the lumbar spine and pelvis. The trabeculae appear to be rather coarse and less well-defined than normal; gradually an ill-defined increase in the density occurs. Where the detail can be more closely studied, as in the ribs and sternum, this increase in density appears to be due to denser and coarser trabeculae. The periphery of the bones loses its sharpness of outline. In the well-developed case the bone is much denser than normal; the outlines of the trabeculae are obliterated. The appearances suggest that some dense granular material has been deposited on them until the interstices of the cancellous tissue were filled. At the site of muscle insertions irregular spicular bony deposits appear to be growing out from the periosteal margins; this will be best seen on the pelvis, the ribs and bones of the forearm and leg. The vertebral bodies show, in addition to an increased density, marked lipping of their bodies, but the disc spaces are not decreased. The lipping of the lumbar bodies may not be associated with any change in the curvature and is relatively equal on both sides. The increased density and the marginal deposits tend to give the bone a somewhat more massive appearance than normal. Unusual ossification of some of the ligaments occurs. The changes are generalized and not associated with any destructive process. The bones do not present the abnormal clubbing with the linear transverse or subperiosteal dense accretions, the increased fragility, or great density and thickness of the skull which characterize Albers-Schönberg's disease. Neither does the latter show the irregular periosteal spicule development at the muscle insertions such as are seen in fluorosis.

Other authors[12, 30-38] agree generally with the foregoing description. At this point, however, all agreement ends, and while some observers interpret the bone changes as nearly catastrophic, others state that these same changes have no relationship to disability or mortality.

Spira[39] (who has shown the greatest prolixity in writing about chronic fluorosis) describes the bone changes as associated with joint stiffening and pain, arthritis, osteoporosis, osteoarthritis, and a large variety of other skeletal dysfunctions. Unfortunately, this author presents no data or factual evidence concerning either exposure to or absorption of fluoride compounds. Others have reported severe bone changes on a better background of information.

Siddiqui,[36] for example, in India, in an area in which the water contained fluoride in the concentration of 11.8 ppm, described 32 cases of skeletal fluorosis with neurological manifestations. The bony changes included, in addition to sclerosis, calcification of the hip-joint capsule and exostoses of the ilium, the ischial tuberosities, and the sacrum. The neurological abnormalities included eighth-nerve impairment, extensor plantar responses of the lower extremities, impaired vibratory sense in the lower extremities, and ankle clonus. In the study of these cases, no attempt was made to exclude other diseases, and the author admits that all those under study were in a poor state of nutrition and probably suffered from severe avitaminoses. The blood fluoride levels were not found to be elevated by the methods of analysis employed.

Venkateswara[37] has described a case of skeletal fluorosis with stiffness of the spine and with neurological findings in both lower extremities. His patient had consumed water containing fluoride in the concentration of 7.2 ppm for 40 of his 45 years. A similar case, reported

by Satyanarayana,[40] is that of a 35-year-old man who was found to have skeletal fluorosis with neurological manifestations (impairment of sensation in both lower and upper extremities). This patient lived in an area in which the concentration of fluoride in the water was 10 ppm. Similar effects were not observed among other persons in the same area. Joint symptoms were described in 25 cases reported by Hamamoto.[41]

Investigations have been carried out in the United States to determine the incidence of the roentgenographic changes of fluorosis and to correlate them, if possible, with clinical evidence of disability. Largent et al.[34] studied men who were engaged in the manufacture of inorganic fluorides. Five of sixteen workers were found to exhibit osseous changes, but they had no disability. All but one of the five excreted fluoride in their urine in amounts exceeding 10 mg/liter. No correlation was demonstrable between the length of time at work and the occurrence of roentgenologic bone changes. Although the number of persons examined was not great, this investigation was one of the most methodical and objective of the recorded approaches to skeletal fluorosis.

Prior to this report, others had investigated large populations whose only source of increased fluoride absorption was drinking water. Hodges et al.[32] found no x-ray evidence of generalized sclerosis in 86 persons who lived in an area in which the concentration of fluoride in the water was 1.2 to 3.0 ppm, and whose period of residence in the area ranged up to 61 years. They reported similar observations in 31 persons (18-75 years of age) in a town where the water supply contained fluoride in the concentration of 2.5 ppm. McClure[42] studied 2,529 young men and 1,458 high school boys residing in areas in which the concentration of fluoride in the drinking water ranged from 0 to 6.0 ppm. The clinical data on fractures of bone, as well as those on height and weight, as derived from this investigation showed no correlation with exposure to fluoride.

The carefully detailed report by Leone et al.[35] in 1955 emphasized further the lack of consistent correlation between the fluoride content of drinking water and the roentgenologic appearance of bones. In the entire literature on fluoride, no long-term investigation has been reported which was carried out with equal thoroughness. In 1943 and again in 1953 roentgenograms of the bones of persons residing in Bartlett, Texas (where the concentration of fluoride in drinking water was 8.0 ppm), were compared with those of persons living in Cameron, Texas (where the concentration of fluoride in drinking water was 0.4 ppm). Minimal changes were noted in a few persons from both areas at both examinations. Osseous changes were found in only 10 per cent to 15 per cent of the Bartlett group, and in no instance were these changes of the same severity as those which have been described in cases of heavy exposure to cryolite or rock phosphate dust. When roentgenographic abnormalities were encountered, they were described as consisting of *(a)* increased bone density with or without coarsened trabeculation and with a "ground-glass" appearance, *(b)* coarsened trabeculation showing lines of stress without increased bone density, and *(c)* increased thickening of the cortical bone and periosteum with equivocal narrowing of bone marrow spaces. No cases of "poker spine" were observed, and there was no unusual incidence of fractures, arthritis, hypertrophic bone changes, or interference with fracture healing.

Stevenson and Watson[38] confirmed further that the incidence of skeletal changes that can be ascribed to the ingestion of water with high fluoride content is indeed low in the United States. These investigators studied 170,000 x-ray films of the spine and pelvis taken at the Scott and White Clinic in Temple, Texas. The persons whose x-ray films were examined came from communities in Texas and Oklahoma where water supplies contained fluoride in excess of 0.7 ppm. Of the total group, only 23 were found to demonstrate osseous changes consistent with skeletal fluorosis. Clinical examination of these 23 persons revealed no unusual prevalence of anemia, arthritis, back stiffness, or renal disease. Fifteen of these patients were known to reside in areas where the concentration of fluoride in the drinking water ranged from 4.0 to 8.0 ppm.

The two foregoing reports have contributed significantly to our knowledge of the relationship between the fluoride content of drinking water and changes in the roentgenologic appearance of bones. It would appear that in the United States, at least, waters that are high in fluoride content do not produce skeletal infirmities. Although roentgenologic bone changes occur in a very small proportion of persons who have absorbed large quantities of fluoride, these changes do not necessarily constitute or lead to disability. Finally, it has been established that large segments of the population whose absorption of fluorides within certain established limits has been lifelong in duration have not been affected adversely. There is no body of clinical or experimental

evidence to indicate or even suggest that these conclusions may be erroneous.

Certain authors have expressed opposing opinions, however, either on the basis of scanty observations or because of specious reasoning. Some have ascribed practically all the ills of man to the absorption of even small quantities of fluoride. Such reports are typified by the publications of Spira, whose fundamental thesis is that fluoride is the etiological agent responsible for abnormalities or disturbances in function of structures of ectodermal origin. According to this writer, alopecia,[43] attached ear lobes,[44] varicose veins,[45] maculo-anesthetic leprosy,[46] otosclerosis,[47] constipation,[48] seborrheic dermatitis,[49] mild degrees or incomplete forms of Addison's disease and Recklinghausen's disease,[50] cheiropompholyx,[49] mottled nails,[51] congenital ectodermal dysplasia,[52] Riehl's melanosis, [53-55] and many other disorders are associated with increased fluoride absorption.

It is significant, perhaps, that this author previously indicted aluminum (particularly from cooking utensils) as the cause of a broad spectrum of human disease and did not transfer his attention to fluorides until about 1942. Although he describes laboratory determinations and investigations of tissues from biopsies in considerable detail, his animal experiments are inconclusive, and his reports contain few data which can withstand critical examination. Most of the literature he cites consists either of very old empirical medical reports or his own previously published opinions. His determinations of fluoride in tissues and body fluids show such wide variations in duplicate samples as to be unacceptable. In order to determine the validity of Spira's observations, a group of Swiss investigators (Held et al.)[56] carried out examinations in an area in which the fluoride content of the drinking water exceeded 1 ppm. They were unable to demonstrate any pathologic manifestations or to confirm any of the effects that had been described by Spira.

From time to time, attempts have been made by others to demonstrate alterations in human physiology that could be ascribed to the prolonged absorption of moderate quantities of fluoride. Thus, Okushi[57] examined the inhabitants of a village in which the fluoride content of the well water ranged from 1.9 to 4.8 ppm. He described cardiac abnormalities in 15 of 25 children and 4 of 10 adults. The changes noted were sinus tachycardia, sinus arrhythmia, myocardial damage, and prolonged Q-T interval. The criteria employed by Okushi for the diagnosis of myocardial damage were not reported, and, since his electrocardiographic technique included only the three standard leads, it is impossible to be certain of their meaning. The tachycardias and the sinus arrhythmias are of doubtful significance, the only finding that deserves critical examination is that of the prolonged Q-T interval. It is obvious that this type of electrocardiographic abnormality can occur as the result of other disturbances (such as electrolyte imbalance), and there is no evidence that the change in Q-T interval is related to the absorption of fluoride.

The contention that the prolonged absorption of comparable quantities of fluoride produces deleterious effects was supported by Takamori,[58] Japanese author. Careful review of his data, however, shows that the group in whom he reports changes in height and weight, mottling of teeth and alterations in blood elements is that same group as that studied by Okushi.[57] None of these observations has ever been confirmed by any other investigator.

A number of reports[59-61] in the literature describe minor types of dermatitis, gastrointestinal disorders, nasal irritation, increased rates of respiratory illness, and a variety of blood changes in groups of persons who have ingested waters that contain as little fluoride as 1 ppm. None of these reports is substantiated by acceptable clinical or experimental evidence.

The study by Black et al.,[62] who administered sodium fluoride as a therapeutic measure to more than 70 patients with malignant diseases, is worthy of note. The dose given to adults was 320 mg. per day (80 mg four times a day), and to children, 80 to 200 mg. per day (20-50 mg four times a day). He observed no evidence of systemic intoxication, although some patients ingested more than 27 gm of sodium fluoride during a period of three months. His examinations included observations of the growth and development of the children; the eruption of their permanent teeth, their hematologic patterns; their liver function, albumin-globulin ratios, and blood sugar and cholesterol levels; and their renal function. None of these was abnormal. The only change noted was a tendency toward reduction of the blood pressure, especially among hypertensive patients.

Among other organs that have been said to be affected adversely by fluoride absorption are the thyroid gland[63, 64] and the parathyroid glands.[39, 65] Because of these suggestions, considerable attention has been devoted to the study of these organs by Held,[66] Demole,[67] Korrodi,[68-70] Levi,[71] Jentzen,[72] and Straub.[73] These authors are all in agreement that in-

creased absorption of fluoride does not result in thyroid or parathyroid dysfunction.

One of the more extensive of the epidemiologic surveys that have been carried out was that reported in 1952 by the Illinois Department of Public Health.[74] No real or statistical difference in mortality rates was found to exist among persons who lived in "fluoride" and "nonfluoride" areas. Of equal importance was the fact that there was no significant difference between the two areas with respect to the risk of death from specific diseases, such as heart disease, cancer, nephritis, and diabetes. There is no evidence in the literature that has been published that even implies that this information may not be correct.

Despite the many "clinical" reports that have been published concerning the effects of the fluoride ion on the human organism, comparatively little attention has been devoted by the large proportion of investigators to fluoride intake, output, and retention in the body. There can be little doubt that much of this inattention has been due to the fact that the analytical methods have been difficult and many of them have been unreliable. Certain reports, however, have contributed much to the knowledge of fluoride metabolism, and these do deserve mention.

Some of the earliest determinations were carried out by Machle et al.,[75] who showed that at levels of intake of fluoride in the range of 0.5-1.0 mg/day, a normal subject maintains a balance between intake and output. More than 80% of the fluoride that is ingested is absorbed and excreted in the urine, and measurable storage of fluoride does not occur. The quantity of fluoride lost in the perspiration, at these levels of intake, even under conditions of forced sweating, was too small to be estimated by the analytical method that was used. Although analyses were not done on saliva, tears, nasal secretions, desquamated epithelium, semen, and hair, it was concluded (from the difference between intake and output) that the total of all these losses (including perspiration) could not have exceeded 5%. McClure et al.[76] were able to find measurable amounts of fluoride in the perspiration of persons who were subjected to artificial "hot-moist" conditions.

At higher levels of fluoride intake (6 mg/-day), Machle et al.[77] found that absorption of fluoride varied with the solubility of the salt administered, the presence or absence of large amounts of calcium in the enteric tract, and the form in which the fluoride salt was administered. It was further determined that both the absorption and excretion of fluoride increased, and that the amount of fluoride excreted in the urine varied directly with the quantity that was absorbed. The degree of retention in the body also varied directly with the amount absorbed. Within certain limits, therefore, the amount of fluoride excreted in the urine may be used as a measure of fluoride ingestion and retention. Confirmation of these data was provided by McClure and Kinser,[78] who reported that the amount of fluoride in urine specimens was proportional to the fluoride content of the drinking water within the range of 0.5 to 5.1 ppm.

When greater amounts of fluoride (12-25 mg/day) were ingested in aqueous solution, Largent and Heyroth[79] demonstrated that 93% to 97% was absorbed and that 37% to 48% of this amount was retained in the body. Urinary fluoride levels were increased (3.17 mg/liter) and "spillage" of fluoride, manifested by its excretion in excess of the amount ingested, continued for more than two years (at a progressively decreasing rate) after resumption of a normal intake of fluoride. These reports have contributed valuable leads toward better understanding and recognition of clinical phenomena which may result from increased fluoride intake, but it should be remembered that oral ingestion is only one route by which the absorption of fluoride can occur.

For example, the absorption of fluoride under occupational conditions may result from the inhalation of gaseous or finely divided particulate fluoride or through swallowing fluoride-containing dust collected in the upper respiratory tract or coughed up.[34, 80-83] Collings et al.[83] have shown prompt but temporary increases in urinary fluoride output after exposure for one day to gaseous fluoride compounds (HF and SiF_4) and to "insoluble" rock phosphate. They affirm that the two forms of fluoride (gaseous and "insoluble") are equally well absorbed by the lungs. Caution is suggested, however, in accepting their conclusion that the "elevation of the rate of urinary fluoride excretion occasioned by the exposure during one work shift will have returned to normal before the next shift begins." This statement was made on the basis of data obtained from persons following a single brief period of exposure and is not in agreement with the results of the experiments of Machle[77] and Largent.[84] It is obvious that more attention must be directed toward investigation of the absorption and excretion of fluorides among workmen subjected to prolonged periods of daily exposure to fluorides before more definitive conclusions can be drawn concerning the precise quantitative relationships that exist between dosage, absorption, excre-

tion, and retention of fluoride in the body, as these are influenced by the factor of time.

Discussion

This review has been devoted to the consideration of reports which have emphasized the possible physiological effects on man of prolonged absorption of fluoride at levels well above those associated with the "normal" environment. No special attention was devoted to any beneficial effects (dental health) or to the mottling of tooth enamel, since these matters have been examined thoroughly by other reviewers. For the purposes of this review, mottled enamel is not a disease process, nor is it considered to be a precursor of such a process.

The acute reaction that is produced by the absorption of overwhelming amounts of fluoride has not been found to be in dispute, and hence has not been dealt with here. The physiological upheaval that results from this type of intoxication is violent and swift, and, while it has been described satisfactorily in clinical and pathological terms, its essential mechanism (or mechanisms) is far from clear. Of great practical importance, however, is the fact that a well-defined time relationship exists between the administration or the accidental ingestion of a toxic dose and the reaction of the organism. This relationship, which is readily established in most instances of human poisoning, has served to remove the aura of uncertainty or mystery which, otherwise, might well cling to this clinical entity. This is not true of the so-called chronic fluorosis, of which the one definitive manifestation—or, more precisely, the site of manifestation—lies in the osseous tissues, and is characterized by abnormalities in the structure of the bones (and their closely related tendons), including the teeth, in association with the deposition therein of abnormal quantities of fluoride as calcium fluoride or calcium apatite.

With respect to chronic fluorosis, as indicated previously, the question arises as to whether the skeletal abnormalities, especially in their milder form, without demonstrable dysfunction or disability, constitute a genuine disease process. It is clear that the available evidence demonstrates that deleterious effects upon human health have not followed long-continued absorption of moderate quantities of fluoride, even under conditions which result in the deposition of appreciably abnormal quantities of fluoride in the skeletal tissues.

Not always is it possible to visualize by x-rays, in the intact organism or post mortem, increases in the density, or minute changes in the structure, of bones that are the site of increased deposits of fluoride, and experimental evidence has shown that the process of such deposition is reversible. So avid is the skeletal depot for abnormal quantities of fluoride that the soft tissues are spared, and, under the conditions of persistent or intermittent, moderate elevation of the absorption of fluoride, the concentration of fluoride in the soft tissues and body fluids is maintained at a low, only slightly elevated, level. Whether or not insidious or overt deviations from strictly physiological processes occur in the body from time to time under these conditions is the controversial issue which has contributed voluminously, and thus far negatively, to the literature of this subject. Continuing investigation of controlled occupational conditions and of men who work regularly and for many successive years under conditions which fulfill presently acceptable standards of industrial hygiene (which nevertheless result in 5-fold to 10-fold increases in the rates of the absorption and excretion of fluoride above normal or usual levels) have failed to reveal such deviations. More recently, clinical and epidemiologic investigations of human populations (and briefer but more intensive study of individuals), in areas in which the concentration of fluoride in the drinking (and culinary) water has long been as high as 5 ppm, have yielded no adverse evidence. The conclusion seems fully justified that the human organism, adapted by the long biological process to an environment in which fluoride is an inescapable, albeit variable, constituent of the soil, the water, the air, the vegetation, and the animal life, is fully capable of handling fluoride, within certain quantitative limits, without harm (and to some extent with benefit); that these limits, which may be exceeded both in nature and by human artifice, have been defined for men, generally, through the study of individuals and of human populations in different areas of the earth and in various occupations, and through experimental investigations which have revealed the pattern of the metabolism of the fluoride ion in the living organism. These limits, as substantiated by present evidence, may be expressed in certain practical terms, as follows:

1. Persons beyond the age of dentition, who live and work under average or ordinary conditions with respect to exposure to fluorides (i. e. free of occupational or other adventitious exposure), may use drinking and culinary water containing fluoride up to the level of 5 ppm without cosmetic effect and without risk

of harmful or deleterious effect upon their health and well being.

2. Persons whose occupations give rise to absorption of fluoride (disregarding moderate variability in their absorption of fluoride from other sources) need anticipate no harmful effect from their occupational (and nonoccupational) absorption of fluoride so long as the rate of their urinary excretion of fluoride does not exceed 5 to 8 mg per day (more commonly expressed in terms of concentration within the limits of 5 to 10 mg of fluoride per liter and averaging from 5 to 6 mg per liter). This statement does not carry with it the implication that higher excretory levels are necessarily or probably indicative of harmful conditions of exposure to, or absorption of, fluoride. Rather, it is presented as a standard of good industrial practice based on experience, under which men may be expected to work, indefinitely, in safety and well-being, in occupations which are associated with some degree of exposure to fluoride.

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INDUSTRIAL TRAUMA

II. Emergency Management of Thoracic Trauma

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SINCE the dawn of civilization thoracic trauma has been a major cause of disability and death to man. Unfortunately, it has required the stimulus of two major wars with their numerous chest injuries to encourage us to acquire the basic knowledge essential for their management. The increasing numbers and horsepower of the automobile will furnish us sufficient material and impetus for further improvement in their management.

Despite industry's constant modification and improvement of its equipment and education of its employees as to its proper and safe use, many injuries to the chest and its contents continue to occur. It therefore behooves the industrial physician to become thoroughly familiar with the recognition and emergency care of these injuries.

The problem arising in chest injuries is usually in impairment of movement of adequate oxygen to the aveolar-capillary membrane of the lung and then to the body tissues by way of the blood vessels for support of cell metabolism. This is usually due to one or more of five mechanisms: (1) block or obstruction to the flow of air, (2) impairment of the movement of the air to the lung capillary, (3) loss of capillary surface through collapse of or damage to the lung, (4) decrease of flow of oxygen to the body tissues by loss of its blood vehicle, and (5) failure of the heart or blood propellor.

The immediate and definitive management of chest injury is therefore dependent on obtaining the following essentials by the most expeditious means: (1) a patent airway to the terminal alveoli of the lungs; (2) normal integrity, stability, and motion of the chest wall and diaphragm; (3) maximum expansion of the lungs; (4) an adequate blood volume; and (5) a normal heart for movement of blood through the capillaries of the lung and body.

Generally correction of the cardiorespiratory difficulties takes precedence over all other injuries, but in many instances simultaneous correction of multiple injuries will be required.

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Maintenance of Adequate Airway

Correction of an obstructed airway takes priority over all other treatment. A block of only a minute or so in a critically injured patient may result in death.

Obstruction may be due only to loss of tone of the tongue muscles, with resultant so-called swallowed tongue. Vomitus or severe hemorrhage around the mouth and larynx may be aspirated into the tracheobronchial tree. Severe trauma of head, face, or neck may result in obstruction from displacement of body tissue or reactive edema. Fracture of the tracheal cartilages may result in collapse of the trachea, or even traumatic transection of the trachea may occur. Obstruction should be suspected and diagnosed when cyanosis is seen, stridor is present, when the accessory muscles of respiration are being used, if retraction of the intercostal spaces and supraclavicular spaces is observed with inspiratory efforts, when the so-called respiratory death rattle is heard, and when little or no movement of air is detected with respiratory efforts.

Relief of obstruction is often obtained merely by elevation of the chin or grasping the tip of the tongue and pulling it forward, particularly in a comatose, flaccid patient. Turning the patient on his side or stomach to allow drainage of secretions from the pharynx and mouth may suffice to remove or keep further vomited material or blood from the trachea. Aspiration or removal of material from the mouth and pharynx even by a hooked finger if nothing else is available may be effective. The block may be more distal, from the trachea to well out in the terminal air passages. Not infrequently stimulation or encouragement of the patient to cough vigorously will clear the tree effectively, particularly if the block is due to liquid materials. If cough fails to clear the air passages

tracheal aspiration should be done immediately. Every physician should become proficient in the passage of a tracheal catheter and use it without hesitation when necessary. Even if passage of the catheter into the trachea is unsuccessful, the cough stimulated by irritation of the larynx may clear the tree.

If none of these methods have cleared the airways, tracheostomy should be done without hesitation. It is much better to err on the side of a later-proved-unnecessary tracheostomy than to hesitate, allowing irreversible anoxic changes from a blocked airway. Intubation by means of an endotracheal tube may also prove effective but may not be feasible if extensive injury of the mouth has occurred.

A patient with a tracheostomy, because of bypass of the glottis, loses much of the efficiency of the cleansing effect of his cough due to the inability to build up sufficient air pressure in his lungs behind a closed glottis to blow or blast the excessive or foreign materials from his tracheobronchial tree. He will therefore require frequent cleansing of the tree by catheter aspiration. When the airway has been cleared, continued patency must be assured. This may require only a mouth airway. Tracheostomy, of course, may be maintained as long as necessary.

Oxygen, preferably humidified, should be given as soon as available. The nasal catheter is the method of choice in the usual emergency situation with a patent airway the tracheostomy site presents an ideal opening for introduction of a small oxygen-carrying catheter.

Maintenance of Normal Integrity and Motion of the Respiratory Cage

The "sucking wound" of the chest constitutes the most pressing immediate emergency in this respect and can easily and quickly be controlled, even with the heel of the hand if nothing else is immediately available. The larger the wound the more pressing the need of control. An opening larger than that of the tracheal lumen is incompatible with life. Airtight closure of the opening should be obtained as quickly as possible. This can be done most quickly by means of petrolatum (Vaseline) gauze or some similar preparation held in place with a good firm pressure dressing until facilities are available for definitive debridement and airtight surgical closure of the wound.

Pain, usually resulting from fractured rib or ribs, may severely limit the motion of the rib cage and thus respiratory exchange. Point tenderness, particularly if associated with bony crepitation, abnormal motion, or deformity, should be considered and treated as fractured rib until proved otherwise. Control of this pain can be obtained most effectively and quickly by intercostal nerve block with 1% procaine (Novacaine) hydrochloride or 1% lidocaine (Xyclocaine) in 3 to 5 cc increments placed at the inferior margin, and some 4 to 5 cm. proximal to the fracture site of the involved rib and can easily be performed with materials available in the average physician's bag. One or two ribs on either side of the fractured rib or ribs should also be blocked because of the anatomical overlap of the intercostal nerve distribution. One block is often effective in obtaining permanent relief of the pain and may be readily repeated as necessary.

If materials for intercostal nerve block are not immediately available the time-honored adhesive strapping of the chest may be employed. Marked impairment of respiratory exchange may occur, with possible dire consequences if a band that completely encircles the chest is employed and such a band should therefore be carefully avoided.

Analgesics may be considered to reinforce the nerve blocks, but severe respiratory depressants, particularly morphine, should be avoided. Codeine in ½ to one grain increments or small 25 to 50 mgm. doses of demerol, at frequent intervals, as necessary, usually suffice to control the pain.

"Flail chest," with its accompanying impairment of tidal exchange as a result of paradoxical motion of the chest wall, may constitute a serious problem. Heavy blunt trauma is the usual mechanism of injury and often results in fractures of ribs at multiple sites and thus instability of a segment of the chest wall. A heavy pressure pad over the paradoxing segment may afford sufficient stabilization. Sand bags have occasionally sufficed. More serious paradox or flail may require traction elevation, which can be quickly and efficiently obtained by placing a towel clip through the skin and around each side of the rib in the center of the paradoxing segment. Manual traction on the clip will stabilize the chest until proper weighted traction can be applied. It should also be noted that sufficient tidal exchange may be obtained by mouth-to-mouth artificial respiration despite a severely paradoxing chest wall and may well tide the patient over until more definite care can be obtained. In fact, this principle of so-called internal fixation or stabilization of the chest wall, using the Morch or similar type respirator attached to a tracheostomy tube, is rapidly becoming the favored method of rib-cage stabilization in our larger medical centers.

Rupture of the diaphragm, although uncommon, may permit herniation of the abdominal contents into the pleural space, with resulting collapse of the lung. Operative reduction of the herniated viscera and repair of the rupture should be done as soon as adequate facilities and personnel are available.

Maintenance of Maximum Expansion of the Lungs

Collapse of the lung commonly accompanies chest trauma. Air (pneumothorax) or blood (hemothorax) or both (hemopneumothorax) occupy space normally occupied by lung, with reduction of effective lung volume often to a degree insufficient to support life.

Air may enter the pleural space through an external or sucking wound as previously noted, but it more commonly gains access along with blood through injured lung tissue. Lung injury usually results from direct force or from penetration of rib fragments or of a penetrating missile. Tension pneumothorax may develop, with mediastinal shift and collapse of the uninjured lung. In rare instances there may be an actual avulsion of a large bronchus from a sheering force. Rupture of a bleb or bulla, from sudden increase in intrapulmonary pressure against a closed glottis may occur.

The presence of subcutaneous emphysema anywhere over the chest wall with known trauma should indicate underlying pneumothorax. With respiratory distress there is usually bulging of the intercostal spaces and supraclavicular notches. The percussion note is tympanitic with pneumothorax and of course flat with fluid or blood. Diagnosis and initial relief of the acute distress can be quickly obtained by introducing a moderate-sized needle, 18 gauge or larger, through the chest wall in the second intercostal interspace in the midclavicular line for suspected pneumothorax and in the seventh interspace in the posterior axillary line for blood, using local anesthesia and aspiration of the blood or air. The aspiration may be repeated as necessary but it is probably advisable to insert a tube through the chest wall at the diagnostic needle tap site for safe and most rapid definitive control. The largest catheter available should be used, particularly if blood is the offending agent, and it is best inserted through a chest trocar, but the catheter may be placed directly through a small stab wound with a large Kelly or similar type clamp if a trocar is not immediately available. Sufficient length of additional tubing should then be attached to the catheter to permit placing the end under water or attaching it to a water trap bottle or to a set of chest suction bottles. Not uncommonly treatment of both pleural spaces will be required.

Massive air leaks or blood loss through the chest catheters may indicate emergency thoracotomy or at least evaluation by personnel who have the experience necessary for such consideration. Rapid intrapleural bleeding may result in a clot that cannot escape through the tube. It is therefore necessary regularly to check the position of the trachea in relation to the suprasternal notch and to percuss out the heart border to detect shift of the mediastinum, as shift due to clotted blood indicates immediate thoracotomy. Wounds at the sternal borders, para vertebrally or with extensive rib fractures should be particularly observed for continued intrapleural bleeding. Systemic arteries such as the intercostals or internal mammaries are notorious for continued bleeding until ligated, whereas bleeding from the low pressure smaller lung vessels tends to cease shortly.

Maintenance of Normal Blood Volume and Heart

Blood loss should be replaced as rapidly as possible to combat shock and to provide a normal vehicle for transportation of oxygen to and carbon dioxide from the tissues.

The steering wheel of the modern cars has become a common lethal weapon of our time. The sternal region is often heavily contused from impact of the wheel, along with severe contusion and (rarely) even rupture of the underlying heart. Such patients may be suspected of having acute myocardial infarction. Shock out of proportion to apparent blood loss should suggest heart injury, particularly if the patient does not respond to antishock measures. The diagnosis may be confirmed by electrocardiography, in which event management, so far as possible, should be the conventional medical therapy of myocardial infarction.

Summary

The essentials of the emergency management of chest trauma are outlined. The diagnoses and emergency management of the commoner entities using these principles are discussed. The use of facilities and materials available to the average physician is described.

Use of many of the principles and methods of treatment often will be required for the same patient and perhaps, simultaneously.

(Dr. Ransdell's address is University of Louisville School of Medicine, 323 E. Chestnut St., Louisville 2, Ky.)

Industrial Medical Association

THE PRESIDENT'S MESSAGE

D. JOHN LAUER, M.D.

As we get into the swing of work for another year, we must think ahead of IMA's organizational structure for the next association year. Dr. Robert E. Eckardt, President-Elect, is in the process of making up his lists for committee and counselor appointments. He requests the names of fellows and members who have an interest in some aspect of the Association's work. Would you like to serve on a committee? Which one? Or, do you wish to be considered to represent the IMA as a district counselor? Members can contribute to the IMA and to the field of industrial medicine and surgery in these ways. Generally, it is from these position that the nominating committee chooses the candidates for the directorships and officers. If you have an interest, please make this known to Dr. Eckardt soon. He wants to have a good representation of the membership who are willing to contribute time, effort, and brain power.

In the past year each state has been assigned one or more district counselors. The counselor is the representative of the IMA administration. As such, he reports and interprets policies of the Association to the membership, to our profession, and to the general public in his district. In turn, he is expected to make known the needs and attitudes of the membership in his district to the officers and directors of the IMA. Another important function is to serve as a liaison representative with the component society in his district, to be concerned with the regional trends of industrial medical practice, and to promote the principles of occupational medicine within the industrial community, as well as his state and local medical societies. In carrying out these duties, the district counselor can frequently serve other physicians by acquainting them with the functions of the IMA and the scope of its programs. In some cases he may invite them to apply for membership. Because of his familiarity with the industrial practice in his district, he is expected to make recommendations to the Association's officers regarding those members qualified for various appointments or honors such as fellowship, committee membership, and the association's established annual awards.

In several of the past issues of the JOURNAL we have discussed the work of certain committees. So far as is possible we expect to summarize each one's work and accomplishments during the year.

The Committee on Education and Training, under its able chairman, Dr. Jean S. Felton, has been active each year on its own as well as in liaison with similar committees in other organizations. Presently they have under study a rather complete opinionnaire, the purpose of which is to formulate recommendations for an effective undergraduate curriculum in occupational medicine. On the basis of a sample which gives consideration to geographic distribution and varieties of industry, part-time and full-time physicians in industrial practice are asked to respond to a series of questions. From these replies the committee will develop recommendations as to the content of undergraduate courses in occupational medicine. The committee, further, has been active with other professional groups concerning the establishment of standards in education for undergraduate, graduate, and postgraduate courses. A large file of information which can serve as a guide for interested groups is being built up.

In closing, I would urge members who in the coming year have an interest in serving the association to make their wants known to Dr. Eckardt, our President-Elect. Use the coupon on page 31a.

Editorials

Second Injury Laws and the Cardiac

EACH YEAR, statistics are advanced showing a rise in money spent under workmen's compensation laws. The greatest lack of understanding is revealed when such costs are claimed to be advanced by the hiring of the handicapped, especially the cardiac. Ignored is the total value, in all spheres, of using the abilities of the impaired rather than keeping him confined solely to his disabilities.[1] Much is made of single items, some real, some fancied, few substantiated, which are brought forth as reasons for not hiring the handicapped. When these reasons are exposed they fall by the wayside, since they are not well founded. Many remedies are offered to reduce over-all costs; some have been tried and most rejected. Each remedy has its proponent, who is certain that its application would lead to a complete solution. If the solution is not forthcoming, then the application is incorrect—at least that is the conclusion of the proponent.

One of the methods being resorted to in an attempt to diminish expenditures is the introduction of the second injury law concept, adopted to varying degrees, by about 44 jurisdictions in the United States.[2, 3] Klein,[4] discussing the problems of employment of the cardiac, states: "Under the Second Injury Law the employer of a permanently, partially disabled workman has only a limited direct financial responsibility if the handicapped worker should be further injured or disabled. At most the employer or his insurance carrier is liable for compensation benefits and medical care for only one hundred and four weeks. If the disability continues beyond one hundred and four weeks or if prolonged medical treatment is necessary, payments are made by a Special Fund. Thus, the serious consequences of work accidents to the physically handicapped, do not materially affect the employer's Workmen's Compensation experience and do not increase his insurance costs. It may be truly said that the effect of the New York Law is to save money . . . through the device of spreading the Workmen's Compensation risk. The aim of the Second Injury Law is so precise and its application so simple that it appeals alike to employers and employees."[3, 4]

The significant provisions of the Second Injury Law in New York State are clearly stated. All of the following five conditions must be satisfied, in order that the law may be applicable in a given case:

"1. The previous handicap must be a permanent physical condition, serious enough to be or likely to be a limiting handicap to employment. It may be a previous workmen's compensation injury but not necessarily. It may be a disablement as a result of accident or disease or a congenital condition.

"2. The employer must have knowledge of the previous permanent physical handicap of the employe. This knowledge is basic to the employment decision.

"3. The 'second injury' must be caused by an accident that arises out of and in the course of employment or by an occupational disease, causing disability (or death) for which the employer is required to provide benefits under the compensation law.

"4. The disability resulting from the 'second injury' must be permanent and materially and substantially greater because of the previous handicap than the disability which would be caused by the 'second injury' alone. Should this combined disability exceed one hundred and four weeks, the employer may seek reimbursement from the Special Fund. It does not matter whether the 'second injury' results in partial permanent disability, total permanent disability, or death. If the disability is merely temporary, however, the case does not come within the Second Injury Law.

"5. In all Second Injury Law cases a claim for reimbursement must be filed by the employer or by the carrier in his behalf not later than one hundred and four weeks after the disability from the 'second injury' begins and in any case before a finding has been made by

the Workmen's Compensation Board or referee that the second disability is permanent. Should the employer neglect to file his claim to charge the case to the Special Fund until after the finding of permanency has been made or until after one hundred and four weeks have elapsed, the liability will not pass to the Special Fund. It will remain with the employer or carrier."

It is significant that only permanent disabilities are mentioned in the two paragraphs above and no reference to a diagnosis is made. The records reveal many employees coming to work with known permanent disabilities (cardiac or others) and then sustaining a covered accident resulting in an additional degree of permanent disability (cardiac or otherwise). The employers' payments are limited under these circumstances, although the claimant may continue to receive payments through the Special Fund for extended periods or for life.

A useful second injury law can stimulate the hiring of the cardiac and any other disabled person, present a predetermined risk, spread the cost, and remove the burden from a particular employer. This is certainly a commendable array of attributes for any law to have!

—Guest editorial by Irvin Klein, M.D.

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2. Rosenbaum, F. F., and Belknap, E. L.: Work and the Heart, New York, Paul B. Hoeber, Inc. (medical book department of Harper & Brothers), 1959.
3. Statement No. 2 on Workmen's Compensation—Second Injury Laws—Fall 1959, New York, American Heart Association, Council on Community Service and Education, Rehabilitation Committee, Medico-Legal and Insurance Subcommittee, 1959.
4. Klein, I.: Employment Problems Affecting the Cardiac, New York J. Med. 56:2273-2275 (July 15), 1959.

Book Reviews

APPRAISAL OF THE SAFETY OF CHEMICALS IN FOODS, DRUGS AND COSMETICS. By the Staff of the Division of Pharmacology, Food and Drug Administration, Department of Health, Education and Welfare. Available at $2.00 a copy from J. F. Lakey, Texas State Department of Health, Austin, Texas.

This long-awaited publication is composed of a series of articles which, with one exception, were written by Dr. Arnold J. Lehman and his colleagues. It contains numerous extensions and revisions of an earlier publication covering the same general ground that appeared in the *Food, Drug and Cosmetic Law Journal* of October, 1955.

The pattern of study presented in this guide is described as the "experimental program" of the Division of Pharmacology. Though not literally prescribed by the Food, Drug, and Cosmetic Act or the regulations thereunder, the procedures have almost the effect of law when FDA acceptance of safety evaluation data is the desired objective. In this sense the program of investigation will have far-reaching effect on the future course of technological developments in the industries regulated by the Act.

The volume consists of 13 chapters, the first of which, "Chemical Criteria and Analytical Considerations," was written by F. A. Vorhes Jr., and L. L. Ramsey, of the Division of Food. It deals with matters relating to the purity and reproducibility of composition of additives, the identification of impurities, and the estimation of residues of pesticides, veterinary drugs, packaging components, and intentional additives subject to tolerance limits. Analytical difficulties attending the identification of trace amounts of reaction products, or the estimation of residues present in minimal amounts, may stand in the way of approval of food additives. In this connection the following comments of these authors are significant: "The required approach to each problem is one tailored by due consideration to all aspects of its own set of circumstances. . . . It seems justifiable to match rigor of identification demanded, against known facts regarding hazard that the substance may pose."

The major portion of the book is devoted to chapters concerning acute, subacute, and chronic oral toxicology and to the application of biochemical, pathological, and statistical procedures in the accumulation and assessment of animal response data. The broad experience of the Division of Pharmacology in this area is reflected in the detail with which the methods (and their implied pitfalls) are described. Some toxicologists have challenged the view that two-year feeding studies with supplemental routine hematological and clinical tests are a *sine qua non* of safety appraisal of food additives, or that such studies are a prerequisite to an opinion as to when a minute trace of a contaminant or residue is toxicologically insignificant. Nevertheless, unless FDA departs from its present reluctance to give much weight to "experience based on common use in foods," long-term feeding tests are going to be required on scores, if not hundreds, of substances whose safety in foods as intentional or unintentional additives has not hitherto been questioned.

The current recommendations for toxicity tests are considerably more stringent than they were several years ago. For example, the minimum number of rats for a two-year study is 200 instead of 120; and instead of using only 16 dogs in feeding tests over a one-year period, 24 to 32 dogs are now ob-

served in tests extending over two years. The proposed two-year "screening" test for substances suspected of inducing cancer in man or animals requires the use of 2,400 rodents (two strains of both rats and mice, each strain consisting of 600 animals) and, whereas the number of dogs is not specified, such studies generally entail a minimum of 36, the test period running for seven years.

Animal experimentation in the field of safety appraisal is complicated by the necessity for making observations in the range of minimal effect. In chronic studies it becomes essential to distinguish responses due to test dosage from the "normal" responses incidental to senescence, some of which are only recently coming to light in test animals. Difficulties attending the interpretation of borderline or low-incidence effects, especially when tumorigenesis is a factor, are in part responsible for the large number of animals needed in toxicological appraisals, particularly of food additives. Yet, despite the magnitude and cost of such experimental programs, conclusions that may be derived from them are not unequivocal. Species differences are such that a positive result does not prove potentiality for carcinogenesis in man, although such an interpretation is reasonable and on the side of caution. However, a negative result may prove nothing, except the need for a better understanding of the etiology of cancer(s) and for better biochemical or histological criteria to permit early detection in animals as well as man. Notwithstanding the fact that the conditions under which most drugs and cosmetics are used permit of ready detection of adverse effects, either subjectively on the part of the user or through medical supervision, the procedures for the safety appraisal of these products are, more and more, being directed toward eliciting subtle and chronic effects.

The chapters dealing with the toxicological evaluation of drugs and cosmetic ingredients cover most of the situations encountered in parenteral administration, including dermal application, vapor inhalation, contact with the eyes and other mucous membranes, etc. Special consideration is given to the testing of aerosol preparations such as hair sprays.

A concluding chapter by Dr. Lehman points up some of the more thorny problems in interpreting safety evaluation data. Among these are the chemical characterization of polymeric mixtures or complex organic substances, and the dangers of drawing analogies concerning toxicity between structurally related compounds. Here emphasis is placed upon the exception rather than the rule. On the subject of "trivial components" it is acknowledged that "practically everything man ingests has a 'tolerance' established for it either by the individual himself, or, as in the case of the chemical additive, by adequate pharmacological findings." However, he goes on, "To assemble a list of possible trivial contaminants and to assign to them a concentration value which can be regarded as 'de minimis' for all possible conditions would probably not serve a useful purpose." Whether or not one agrees with this view, it expresses clearly, as do all of Dr. Lehman's pronouncements, the scientific basis for administrative policies.

It is inevitable that this manual will provide valuable guidance to toxicologists, chemists and others responsible for obtaining data to meet the technical requirements of the law. Frequent reference to, and citation from, it will indubitably be made. It is unfortunate, therefore, that the book is inadequately indexed and that the chapters are not numbered. A bibliography or list of references to publications upon which the recommended procedures and interpretations are based would also have been extremely useful.

Despite these failings, the papers collectively reflect the thinking and policies of the government scientists charged with enforcement of federal laws designed to protect consumers against unsafe foods, drugs, and cosmetics. As such it not only will serve scientists in their work but will acquaint company executives in the industries concerned with the extent of their obligations under these laws.

—BERNARD L. OSER, PH.D.

PNEUMOCONIOSIS ABSTRACTS: Volume III—1952-1955. Price, 65s. net. Pp. 376. London, England, Pitman Medical Publishing Co., Ltd., 1959.

This book constitutes an excellent collection of abstracts of papers on pneumoconiosis, and it follows the first two volumes, already published by the Bureau of Hygiene and Tropical Diseases of England. The collection is derived from the abstracts published by the *Bulletin of Hygiene* during the period 1951-1955. Actually these abstracts deal with articles that go back to the late forties.

The arrangement is well ordered according to subjects in 12 sections, ranging from general questions to the specific aspects of dust control. Owing to the phototechnique used for printing, the arrangement of different papers concerning the same topic is not at all times chronological. Nevertheless an accurate analytical index facilitates its consultation, being well supported by the alphabetical index of the authors.

As is to be expected of this sort of compendium, many conflicting views and interpretations are presented; but the critical appraisals of the reviewers, several of whom are well-known experts on pneumoconiosis, counter balances this and converts a potential defect into a very enjoyable reading experience. This third volume of the "Pneumoconiosis Abstracts," as well as the first two, should be considered not only as an important source of literature references but also as a unique textbook on pneumoconiosis, especially suitable for advanced students of this matter.

—M. C. BATTIGELLI, M.D.

Abstracts of Current Literature

Environmental Physiology

From the Practice of Acclimatization of Troops to the Desert. P. A. Solomko. Voyenno-meditsinskiy zhurnal (Military Medical Journal) 4:30, 1959; from translation report by Office of Technical Services, U. S. Department of Commerce, OTS: 59-13, 676, p. 46, July 13, 1959.

Military personnel from temperate regions of the U.S.S.R., reassigned to duty in hot deserts on the southern border (Kara-Kumy;Kyzyl-Kumy) are frequently incapacitated by heat. Soldiers in their first year of duty at these stations are two to three times as susceptible to heat illness as are those in their second year. This article reports a study of the acclimatization period necessary for good combat effectiveness. Body temperature, weight deficit, and time for recovery of pulse and respiratory rate after standard exercise are used to measure heat tolerance in each new replacement. On this basis he is assigned to one of three groups: high heat tolerance (about 60% to 65% of all replacements); medium (30% to 35%); and low (7% to 10%). Each group follows a slightly different schedule of exercises, drills, and conditioning marches of gradually increasing intensity and duration, beginning with brief periods during cooler hours and culminating in a 5 kilometer quick march during daytime heat at temperatures exceeding 45°C (113F). By this time all but a small percentage have acquired good tolerance and are assigned to regular duties. In case of the first two groups the time required to achieve this level of acclimatization is about 30 days in the fall, 40 days in the early spring, and 45-50 days in late spring and summer. Longer periods are required for the low tolerance group. Approximately 2.5% to 3% of replacements cannot be acclimatized even after one year and must be reassigned to cooler climates. All men repeat an abbreviated acclimatization schedule each spring.

As a result of this program there has been a one-and-one-half-fold increase in work output and a two-and-one-half-fold decrease in heat illness.

—D.M.

Environmental Protection Research by Means of Radio Telemetry: Part I. Telemetric Instrumentation and Examples of Field Use in Studying-Clothing-Environment System. F. W. Botsch,* J. J. Powers, and A. A. Koch. Technical Report EP-119, Headquarters, Quartermaster Research and Engineering Command, Quartermaster Research Engineering Center, Natick, Mass. Oct. 1959. (*Environmental Protection Research Division, Biophysics Branch, Quartermaster Research and Engineering Center, Natick, Mass.)

Radiotelemetry adds a new dimension to field physiology by substituting radio waves for mechanical links between heavy recording equipment and the subject, thus permitting him to move freely in his natural environment.

In the system described here the subject carries an instrument pack weighing only 7 lbs. Miniature sensing elements, such as thermistors, convert up to eight physiological or physical variables into variable electrical resistances or capacitances. A motor-driven commutator (1 rpm) inserts these in sequence into the transducer circuit, whose output oscillates at an audio frequency which varies directly with the magnitude of the measured variable. The transducer output modulates the amplitude of the carrier wave of a radiosonde transmitter (1680 mc). A short antenna on the subject's helmet liner transmits the radio wave to a receiver located up to three miles away. After reception, the audio frequency component of the signal is recorded as discrete pulses on magnetic tape which can be monitored immediately in analog form by readout on a recording rate meter. For final analysis, however, the data stored on tape are converted later through successive automatic steps to digital form on IBM punch cards, readout being in terms of the calibrated magnitude of the variable. In this manner, massive quantities of data can be reduced rapidly and automatically without tedious handling by human operators. Examples are given of fluctuating patterns in heat flow at clothing boundaries with transient changes in the thermal environment as the "forcing variable," on the one hand, and with changes in exercise rate, on the other. —D.M.

Radiation Health

Medical Survey of Rongelap People, March 1958, Four Years After Exposure to Fallout. R. A. Conard, J. S. Robertson, L. M. Meyer, W. W. Sutow, W. Wolins, A. Lowrey, H. C. Urschel Jr., J. M. Barton, M. Goldman, H. Hechter, M. Eicher, R. K. Carver, and D. W. Potter. Brookhaven National Laboratory Report BNL 534 (T-135) May, 1959. (Available from the Office of Technical Services, Department of Commerce, Washington 25, D. C., $1.25)

Annual medical surveys have been conducted on the Marshallese people of Rongelap Atoll who were exposed to radioactive fallout from a thermonuclear device test in March, 1954. Sixty-four inhabitants of Rongelap Island received an estimated 175 r whole body gamma radiation, burns and epilation from beta contamination of the skin, and slight internal absorption of radioactive material. Smaller groups of Marshallese and American serviceman at other locations received lesser exposures. Two-thirds of the group receiving the greatest exposure experienced anorexia and nausea. A few vomited. About two weeks later, beta burns of the skin and epilation developed in most of the members of the group. Lymphocyte, neutrophil, and platelet levels fell markedly. No one died.

Abstracts

The report presents results of the March, 1958, examinations. At that time the principal evidence of exposure were some pigment abberation, scarring, and atrophy fallowing beta burns in 12 cases; a statistical persistence of lower than control platelet levels; and small internal amounts of Cs^{137}, Sr^{90}, and Zn^{65}. Comparison of mortality, and morbidity of other conditions, indicated insignificant differences.

A corollary blood-typing program done for anthropological purposes demonstrated closer relationship of Marshallese to Southeast Asians and Indonesians than to Mongoloids, Eskimos, or American Indians. —T.S.E.

Administrative Experience with Occupational Overexposure to Radiation. M. Kleinfeld* and A. P. Abrahams. Am. Indust. Hyg. A. J. 20:294 (Aug.) 1959. (*Division of Industrial Hygiene, New York Department of Labor, New York)

During a three-year period (1956-1958), 19 instances of radiation exposure exceeding maximum permissible limits were reported to the New York State Labor Department. In eight instances the excessive radiation readings resulted primarily from faulty dosimetry techniques and did not involve personnel overexposures. Four instances of chronic overexposures to 31 workers in radium processing and field radiography resulted in estimated doses ranging from 7 to 60 rems per quarter-year. Four of the 31 developed radiodermatitis, and one had excessive internal deposition of radium and polonium. In four instances of acute external radiation exposures of 300 to 1,100 rems, three radiation burns developed among 16 exposed individuals. Three instances of acute exposure to internal emitters exposed a total of 22 persons to estimated doses of 0.2 to 10 rems. The principal causal factors in these exposures were lack of proper supervision, lack of awareness of the hazard, and failure to provide or maintain appropriate protective devices. —G.L.V.

Experimental Toxicology

Toxicological Studies on Hydrocarbons: V. Kerosine. H. W. Gerarde.* Toxicol. & Appl. Pharmacol. 1:462 (Sept.) 1959. (*Esso Research & Engineering Co., Linden, N. J.)

In an attempt to form a rational basis for the treatment of clinical kerosine intoxication, the mechanism of the pneumonitis following kerosine ingestion was studied. Animals were dosed by various routes of administration, and the rate of absorption and elimination of kerosine hydrocarbons from the blood, the effects of various diluents on these processes, and the gross and microscopic pathological changes are reported. Large doses are tolerated by gastric intubation, subcutaneously and intraperitoneally, but less than 1 ml instilled directly into the trachea or aspirated from the mouth into the lungs caused pulmonary edema, hemorrhage, and death in rats. Aromatic hydrocarbons are absorbed into the blood from the gastrointestinal tract. Absorption is promoted by mineral oil and delayed by olive oil. Since pneumonia is apparently the result of aspiration and not absorption into blood from the gastrointestinal tract, the induction of vomiting is contraindicated, also, antiemetics which tend further to depress the central nervous system. Recommended measures are oxygen, antibiotics prophylactically, and vegetable oils, if the patient is conscious. —R.E.E.

Prednisolone in the Treatment of Oedema Induced by Irritant Gases. D. Henschler* and K. O. Jacob. Klin. Wchnschr. 36:684, 1958; Excerpta Med. (II) 12:680 (#3088) (July) 1959. Pharmakologisches Institut, Universität Wurzburg.

Experimental pulmonary edema was induced in rats by inhalation of a mixture of ozone or nitrous (?) vapors in air for 30 minutes. Rats given 8.5 mg/kg prednisolone intraperitoneally for three days before exposure had a significantly smaller lung weight than controls for a period of 10 hours to 3 days after exposure. By this time the pulmonary edema was 36% less than that in controls. Effective treatment requires repeated prednisolone injections to maintain a constant blood level. The death rate was not reduced by the treatment at LD_{100}, but rats survived for a longer period if given prior injections of the drug. —R.E.E.

Experimental Cancers in Rats Produced by Chromium Compounds and Their Significance to Industry and Public Health. W. C. Hueper* and W. W. Payne. Am. Indust. Hyg. A. J. 20:274 (Aug.) 1959. (*National Cancer Institute, Bethesda, Md.)

Calcium chromate, sintered calcium chromate, and sintered chromium trioxide when introduced in pellet form into thigh muscle tissue and into the pleural cavity of rats induced sarcomas in the majority of animals at the site of implantation within 4 to 14 months. Less soluble barium chromate did not induce tumors. These studies give support to the concept that the degree of biologic availability as determined by solubility and amount present controls the carcinogenicity of chromium compounds. These chromates of medium solubility, introduced as a pellet, provide conditions of prolonged exposure to chromium in relatively small amounts, insufficient to produce tissue necrosis. Once in the cell, the chromium is converted into biologically active, protein-bound, stable trivalent chromium. Studies are continuing on highly soluble chromates. —R.E.E.

The Comparative Toxicity of Certain Lithium Compounds in Acute Experiments on Animals. V. I. Neretin. Pharmacol. & Toxicol. 21:419 (July-Aug.) 1958.

Solutions of lithium compounds were injected subcutaneously or given orally to white mice, and the comparative toxicity of the compounds was de-

termined on the basis of survival and general condition. Toxicity was found to decrease in the following order: lithium hydroxide > lithium carbonate > lithium chloride > lithium acetate. The clinical picture of acute lithium poisoning was identical for all compounds. At autopsy, pronounced vascular disorders, specifically polyemia and perivascular and pericellular edema, were observed. —R.E.E.

Clinical Toxicology

Artificial Hemodialysis in Management of Glutethimide Intoxication. B. F. Chandler,* W. H. Meroney, S. W. Czarnecki, R. H. Herman, M. D. Cheitlin, L. R. Goldbaum, and E. G. Herndon Jr. J.A.M.A. 170:914 (June 20) 1959. (*Walter Reed Army Hospital, Washington, D.C.)

This paper reports the treatment of two cases of intoxication by glutethimide (Doriden), a new nonbarbiturate sedative drug. Artificial hemodialysis is indicated as a therapy for intoxication when patients do not respond to conservative therapy and the intoxicant is dialyzable. In both cases presented, there was a favorable outcome after hemodialysis. The authors discuss the toxicity of glutethimide and show the relationship between blood level and clinical status. There is additional discussion concerning the desirability of gastric lavage in such patients in view of the prolonged period of absorption of the material from the gastrointestinal tract. —A.D.

Effect of Alcohol on the Liver. G. Klatskin.* J.A.M.A. 170:1671 (Aug. 1) 1959. (*Department of Internal Medicine, Yale University School of Medicine, New Haven, Conn.)

The author discusses the relationship between ethyl alcohol ingestion and hepatic injury. While a direct causal relationship between alcohol ingestion and the development of hepatic injury has never been proved, it has been shown that alcohol enhances the hepatotoxic effects of agents such as carbon tetrachloride, chloroform, and phosphorus. Moreover, careful studies show a significant incidence of Laënnec's cirrhosis in chronic alcoholics. The possible mechanisms for the development of cirrhosis in alcoholics are discussed. They include nutritional factor deficiency, interference with the enzymatic activities of the liver, and the possible role of viral infection in producing fibrosis where cellular damage has been initiated by the toxic agent. —A.D.

Treatment of Anticholinesterase Intoxication with Oximes. D. Grob* and R. J. Johns. Neurology 8: 897 (Dec.) 1958. (*State University of New York College of Medicine, New York)

This study compares the effectiveness of pyridine-2-aldoxime methiodide (2-PAM) and diacetyl monoxime (DAM) in the treatment of the neuromuscular block produced by organophosphorus anticholinesterase compounds such as Sarin. Observations were made of the effects of the oximes on motor function in normal subjects and in myasthenic patients after the administration of anticholinesterase compounds. Muscle function was measured by percutaneous electrical stimulation of the ulnar nerve and the recording of action potentials and isometric tension from the adductor pollicis brevis muscle. In both normal subjects and myasthenic patients, 2-PAM and DAM were equally effective in combating the action of each of the anticholinesterase compounds. Both 2-PAM and DAM in intravenous doses of 1,000 to 2,000 mg produced slight to moderate reversal of plasma and red cell cholinesterase inhibition but neither had any effect on gastrointestinal symptoms, sweating, salivation, bradycardia, or central neural symptoms produced by anticholinesterase compounds. Therefore, the oximes must be used in conjunction with atropine in the management of anticholinesterase intoxication. —A.D.

Vanadium Poisoning. S. Hickling.* New Zealand M. J. 57:607 (Dec.) 1958. (*Wellington, New Zealand)

This report of vanadium intoxication describes two cases of illness resulting from exposure to the soot of a boiler of an oil-burning ship. The men were removing the soot from the boiler. In one case, the clinical manifestations developed after two hours of exposure inside the boiler. This man, working without a respirator, developed greenish black tongue, running eyes, running nose, sneezing, and headache. These signs and symptoms cleared within a day or two after his removal from further exposure. The second man worked a full day with a respirator, and at the end of this day developed a black tongue, cough with black sputum, pain and tightness in the chest, and nausea with one episode of vomiting. He was absent from work for one week and was not observed after the first night. Recovery was complete. Laboratory analysis of the soot after ignition revealed a vanadium content of 20% in the ash. —A.D.

Reparative Surgery

Results Following Conservative Treatment of Fractures of the Tibial Shaft. W. D. Holderman. Am. J. Surg. 98:593 (Oct.) 1959.

Fifty-five cases of acute fracture of the tibial shaft in hospitalized patients treated at the University of Kansas Medical Center from January, 1950, through December, 1957, were analyzed. Of nine fractures in children, eight were closed and one open. Seventeen of the 46 fractures in adults were open and the rest (29) were closed. These patients were usually the more seriously injured or those who had unstable fractures, since the stable fractures of the tibial shaft were, in most instances, immobilized in a long leg plaster and the patients were not admitted to the hospital.

Abstracts

Skeletal traction, by means of Steinmann pins drilled through the calcaneus, was used in the initial stage of treatment in 58% of cases. The extremities were supported on Bohler frames. No pin tract infections were encountered. A brace was used in some stage of ambulation in 30 of the adults and 1 child.

From this analysis the author concludes that (1) closed treatment of closed tibial shaft fractures in adults gives generally satisfactory results; (2) complications are far more numerous in open than closed fractures of the tibial shaft; (3) salvage procedures in the form of pedicle skin grafts and bone grafts from bone banks were often unsuccessful, and (4) significant associated injuries of the same extremity or the pelvis were found in almost one-fourth of the adult cases.

—J.T.A.

Stress Fractures of the Calcaneus. J. W. Leabhart.* J. Bone & Joint Surg. 41A:1285 (Oct.) 1959. (*U. S. Naval Hospital, Beaufort, S. C.)

One hundred thirty-four cases of stress fracture of the calcaneus in Marine Corps recruits were studied. The author defines a stress, march, fatigue, or insufficiency fracture as a break in the continuity of presumably normal bone caused by rhythmically recurring subthreshold traumata. The patients of this series were diagnosed from January, 1957, to August, 1958. The incidence of these fractures was 0.45% of the total number of new recruits. Clinically these patients complained of a painful swelling of the heel (or heels) during the first 10 days of training. No history of specific trauma could be elicited. Roentgenograms taken at the time of the first examination were negative. Repeat x-ray studies 10 days after the onset of symptoms usually revealed a definite line or density in the posterosuperior portion of the calcaneus perpendicular to the trabecular stress lines. Treatment of the patients in this series consisted in bed rest for one week, after which four-point weight-bearing with crutches was instituted, with sponge rubber heel inserts in both shoes. Use of crutches was discontinued when symptoms permitted, usually in four to six days. All patients usually returned to duty in eight weeks. No displacement of the fractures was noted. Advancing age and lack of physical activity prior to service appear to increase the incidence of these fractures.

—J.T.A.

Transportation of the Injured. O. P. Hampton Jr.* Am. J. Surg. 98:534 (Oct.) 1959. (*3720 Washington Blvd., St. Louis 8, Mo.)

Adequate emergency medical care at the scene of an accident always includes judicious handling of the casualty. The injuries sustained will determine the type and extent of the treatment to be administered. This care might include some simple procedure to restore or preserve an airway; the control of hemorrhage by a compression dressing; the dressing of wounds; the splinting of fractures; and other procedures to combat shock. The author emphasizes that speed in the transportation of injured persons is seldom necessary. He points out that rushing the casualty to a hospital at breakneck speed while ignoring traffic regulations endangers the lives of many pedestrians and occupants of other vehicles. Before persons with fracture are moved even a short distance they should have the traumatized part carefully immobilized by adequate splinting. Such splinting minimizes "wound shock" and is an important step in resuscitation. Methods of immobilizing extremity and spine fractures are described in detail.

The transportation of unconscious patients and those having thoracic injuries is also described.

Hampton emphasizes that the quality of emergency medical care should be the concern of every practicing physician. Lethargy on the part of physicians in effect condones poor emergency medical care. This, in turn, can jeopardize subsequent definitive care.

—J.T.A.

Mental Health

The Psychologist in Industry. H. Levinson.* Harvard Business Rev. 37:9, 1959. (*Menninger Foundation, Topeka, Kan.)

In a plea for adherence to ethical practice by clinical psychologists in industry, Dr. Levinson states: "Industrial physicians, who have long had to face the identical problem, have solved it by defining the obligations of their one-to-one relationship as being the obligation of physician to patient. The physician fulfills his responsibility to management by reporting in a general way the statistics of health and sickness in his organization, the hazards to be dealt with, and the medical problems which arise.

"On the other hand, few psychologists have reached such a level."

Reviewing the changing role of the psychologist in industry, the increased reliance on clinical techniques involving projective tests, diagnostic investigations and counseling, Dr. Levinson comes to grips with his main theme; optimum ethical psychological services to management. He concludes with four recommendations.

1. Management must select carefully the psychologist with whom it is going to work. Levinson then lists in some detail necessary qualifications.

2. Both psychologists and management need to reappraise the concept of "consultants to management." The author feels that both parties would be much better off if the psychologist were not identified with management. "Rather, he should function as an independent professional person who merits respect because of his interest in rendering the best possible service both to individuals and to groups at all levels."

3. Management must take a more realistic stand

in relation to the psychological services it is presently using. "It must not abdicate its right to make decisions—it can ill afford to put 'halos' around psychological test reports."

4. A major task confronting psychologists in industry has to do with fostering genuine understanding. In writing to this point, Levinson indicates that there is a rule for the psychologist in the application of psychological techniques and insights to industry in an ethical frame of reference. —A.A.M.

Incentives with Paranoid and Non-Paranoid Schizophrenics in a Workshop. N. O'Connor and K. Rawnsley. Brit. J. M. Psychol. 32:133, 1959.

A total of 40 schizophrenic patients was studied in a workshop setting to determine the influence of individual attention, encouragement, special incentives, and psychotherapy on work performance. Twenty paranoid and twenty nonparanoid schizophrenic males were studied. Each group of 20 was, in turn, divided in half, 10 of each serving as a control group and the other 10 as the experimental subjects.

In all four groups there was steady continuous improvement in work performance unaffected by the incentives and treatment used. No measurable change in social behavior of any of the four groups was noticed. —A.A.M.

Industrial Hygiene

Threshold Limit Values for 1959. Committee on Threshold Values, American Conference of Governmental Industrial Hygienists.* Arch. Indust. Health 20:266 (Sept.) 1959. (*Conference Secretary, 1014 Broadway, Cincinnati, Ohio)

On the basis of work accomplished by its standing Committee on Threshold Limits, the American Conference of Governmental Industrial Hygienists issues its recommended threshold limit values for that year. The 1959 report summarizes the suggested values for various gases, vapors, toxic dusts, fumes, mists, and mineral dusts. The report emphasizes the concept that these values "should be used as guides in the control of health hazards and should not be regarded as fine lines between safe and dangerous concentrations." These values should not be considered when one is evaluating a community atmospheric pollution problem. —L.W.S.

Human Health and the Modern Environment. Robert A. Kehoe.* Indust. Med. & Surg. 28:479 (Nov.) 1959. (*University of Cincinnati, Cincinnati)

The microbiological era of medicine has, for all essential purposes, reached its zenith, and with this accomplishment there has been a revolutionary shift of interest to other causes of illness and death at the moment. Among others, there appears to be an "inanimate threat of the machines and materials which inventive man has made, and by the forms of energy with which he has surrounded himself." The time and thought necessary to develop such machines and materials left little time for man to determine what effect these developments would have on him now or in the future. It appears that it would be necessary to "devote an adequate proportion of the financial and intellectual resources of the country to the guidance of modern industrial technology in the ways of human safety and health." Product development and physiologic research must go on concurrently. —L.W.S.

An Appraisal of an Industrial Air Contaminant by Electrochromatography. W. H. Hill* and M. A. Murphy. Am. Indust. Hyg. A. J. 20:387 (Oct.) 1959. (*Department of Occupational Health, Graduate School of Public Health, University of Pittsburgh, Pittsburgh)

Hill and Murphy describe laboratory techniques that they used in combination to study air pollution at an industrial plant which used concentrated solutions of thallium salts in a process for heavy medium separations. An Automatic Smoke Sampler was used to collect dust spots, which were subjected to electrochromatography to facilitate evaluation of sources of contamination. To develop color, sodium sulfide was used to spray the migrated thallium. This was compared with standard quantities of thallium similarly treated. The severity of contamination was then estimated, after which "a log of plant operations and their timing was correlated with the electrochromatographic findings and the processes involved . . . were implicated. When recommendations, designed to correct some of the causes of contamination, were incorporated into plant operation" conditions improved notably. The authors suggest that their technique could, with variation, prove useful in other situations. —M.K.

Industrial Hygiene: Definition, Scope, Function, and Organization. Am. Indust. Hyg. A. J. 20:428 (Oct.) 1959.

A definition of industrial hygiene and a description of its scope, function, and organization appear in a statement prepared by an ad hoc committee composed of Jack C. Radcliffe, Chairman, George D. Clayton, William G. Fredrick, Kenneth W. Nelson, and Elmer P. Wheeler. It was approved recently by the officers and board of directors of the American Industrial Hygiene Association. The academic background and the various cognate sciences required for the practice of industrial hygiene are mentioned. The industrial hygienist is said to need three special abilities. He must be able to recognize hazards, to evaluate them, and to recommend methods by which they may be controlled or eliminated. The scope of industrial hygiene appears as an elaboration of the means and extent to which the aforementioned requisite

abilities of the industrial hygienist should be applied. Ten specific functions of the industrial hygienist are presented. The statement recognizes that regardless of whether or not industrial hygiene activities are situated in health or labor departments, the field is ". . . a profession in its own right" and that an interdisciplinary team approach is necessary to provide workers with protection from industrial hazards. —M.K.

Noise and Hearing

Masking Patterns of Tones. R. H. Ehmer.* J. Acoust. Soc. America 31:1115 (Aug.) 1959. (*U.S. Naval Medical Research Laboratory, U. S. Naval Submarine Base, New London, Conn.)

Experiments were made to obtain sufficiently detailed masking patterns for a sufficient number of frequencies and intensities to choose between aural harmonics and cochlear spread as the basis of extended masking and to better explain the mechanisms of masking. Monaural masking patterns were obtained using masking frequencies, 250, 500, 1,000, 2,000, 4,000, and 8,000 cps, at sensation levels (db above threshold) of 20, 40, 60, 80, and 100 db. A Békésy audiometer was used for presenting the test tones and a separate oscillator provided the masking tone. The masked and nonmasked threshold differences were obtained for 15 points in each octave. The detailed masking curves are given in seven figures. The masking by a 250 cps tone differs somewhat from the masking by other tones in that the masking is not symmetrical for any masking level, whereas the masking for other tones (500, 1,000, 2,000, 4,000, and 8,000 cps) is symmetrical above and below the masking tone for masking levels of 20 and 40 db. Begining with masking tone levels of 60 db, the masking effect spreads rapidly to higher frequencies but much less rapidly to frequencies below the masking tone. For all masking tones tested at 100 db sensation level, the maximum masking of the test frequencies reaches about 60 db. Except for the 500 cps tone, the masking decreases as the test frequency is further removed from the masking tone. It is concluded from the experiments that the pattern of pure tone masking depends primarily on the activity pattern of the tone in the cochlea. Aural distortion plays a smaller role in masking than has previously been credited to it. —H.O.P.

Residual Masking at Low Frequencies. Cyril M. Harris.* J. Acoust. Soc. America 31:1110 (Aug.) 1959. (*Electronics Research Laboratories, Columbia University, New York)

This paper is primarily concerned with the hearing threshold shift measured 150 and 200 milliseconds after cessation of an exposure to a 250 cps tone. The sound pressure levels of the tone was either 90 db or 110 db and the exposure time was 400 milliseconds. The noise exposure time was quite short and the recovery time even shorter in comparison with usual industrial noise exposures. The elevation of hearing threshold level found at 150 or 200 milliseconds after exposure to the noise is called "residual masking" by the author. The threshold elevation or "residual masking" was greatest at the frequency of the exposure tone, 250 cps; being 10-12 db for an exposure to the 90 db sound pressure level and 16 to 18 db for the 110 db sound pressure level. The effect for test frequencies below 250 cps decreased rapidly and was usually less than 5 db at 130 cps. The effect also decreased as the test frequency was increased above 250 cps, falling to a 5-7 db level at 1,000 cps. The "residual masking" at 250 cps resulting from an exposure lasting 400 milliseconds to a narrow band of noise having a center frequency near 250 cps was found to be about 20 db when the sound pressure level of the band was 80 to 90 db. In doing the "residual masking" experiments, the binaural "free field" hearing thresholds were obtained on four subjects (the subjects faced the sound source). These thresholds, for frequencies of 130, 190, 250, 500, 800, and 1,000 cps, were, on the average, higher than those obtained by Fletcher and Munson or those obtained by Robinson and Dadson of the National Physical Laboratory (England). —H.O.P.

Additivity of Different Types of Masking. R. C. Bilger.* J. Acoust. Soc. America 31:1107 (Aug.) 1959. (*University of Michigan, Ann Arbor)

The masked audiogram for a narrow band of noise can be described completely only when one considers three, apparently independent, types of masking. One type of masking is that for the frequencies within and immediately below the band of noise. The critical-band hypothesis explains this masking. The masking for frequencies above the band of noise, the second type, does not depend entirely upon spectrum level and critical-band width. At high intensity levels, a third type of masking occurs below and remote from the lower cut-off frequency of the band. The critical-band hypothesis does not explain this type of masking.

Two types of experiments were performed using a low-frequency band of noise, 20 to 670 cps wide and a high-frequency 2,450 to 6,000 cps wide. In Experiment 1 each band was used at three different levels; the over-all sound pressure levels of the low band were 51.9, 71.9 and 91.9 db, respectively, and the over-all sound pressure levels of the high band were 59.3, 79.3 and 99.3 db respectively. At the two higher levels, in the region between the two bands, the masked audiograms showed a 6 db increase, when the noises were applied together, instead of the 3 db that would be expected if the effects were simply a summing of the bands of noise. The lowest band levels gave a 3 db increase in the masked threshold.

These results indicate that two kinds of masking are being summed rather than two noises. Summing two noises external to the ear would be expected to increase the masked threshold 3 db. The second experiment, performed to determine how

"remote masking" and critical-band masking summate, showed a 3.6 db increase in masked threshold for the lower band pressure levels and a 6 db increase of masked threshold for the higher band pressure levels. This 6 db increase of masking, caused by combining critical-band masking with either of the other two types of masking, suggests that the summation occurs, either within the ear or in the central nervous system, but not outside the ear. —H.O.P.

Medical Care Administration

The Local Health Officer in Occupational Health. H. J. Magnuson.* Am. J. Pub. Health 49:610 (May) 1959. (*Chief, Occupational Health Program, Division of Special Health Services, Bureau of States Services, Public Health Service, U. S. Department of Health, Education and Welfare, Washington, D. C.)

The local health officer often has little time or inclination to think beyond the traditional health activities which constitute the care of his program. Occupational health is a field that is frequently overlooked. The author suggests four misconceptions which have resulted in lack of interest and extremely slow growth of local occupational health activities over the past two decades. First, occupational health is not confined to the mine, mill, or factory; it embraces all places where people work, including the farm. Second, it should not be confined to the identification and control of harmful exposure, in working environment but should be concerned with health maintenance of the employed. Third, industry is too often considered separate from the community instead of as taxpayers and members of the community. Fourth, an occupational health program must be a specialized and separate activity. This may be true in large communities, but in the small communities the activities may be carried out by the basic health department staff.

In extending his department's services to industry, the local health officer will generally be able to secure specialized help from the state occupational health personnel as well as from insurance carriers, voluntary agencies, professional associations, universities, and private consultants.

The health officer cannot shirk his moral and legal responsibilities to know what the problems are and to stimulate action that will lead to their solution through the use of the health resources available to his community. —A.B.

Forces That May Bring Compulsory Health Insurance. Joe Vance.* Hospitals 33:50 (July 16) 1959. (*Assistant Executive Director, Blue Cross-Blue Shield of Alabama, Birmingham, Ala.)

As long as the majority of citizens can afford the expensive hospitals and medical care of today and as long as the individual patient receives that care, the American people will not choose government medicine.

More than half of our population over 65, three-fourths of the farmers, and two-thirds of the families with incomes under $2,000 a year do not have any kind of hospital or medical protection by insurance. In 1955, one-fourth of our population had no cash savings, more than one-half have less than $500, and only one-fourth have more than $2,000. Even in times of prosperity most Americans seem to be living from payday to payday.

The majority of big labor unions with their tremendous health and welfare programs are not going to invite the federal government to take away from them the popular programs they have gained at the bargaining table. Labor likes the principle of selected group practice because it has a chance to control the use and cost of care. It does not follow that it wants the government to step in and help.

Uncontrollable cost forces, an expanding bed capacity, a more comprehensive coverage, and the greatest force of all, an economic depression, will propel the American public into demanding and accepting compulsory health insurance. —A.B.

The White Coat Curtain—Medical Care Versus Industrial Medical Program. Editorial, Indust. Med. & Surg. 28:255 (May) 1959.

Medical care programs often are fostered by industry, and costs or parts of costs thereof are paid by industry. This is apart from the industrial medical program. Industry and industrial medical personnel lack enthusiasm for the union center type of medical service. The best of industrial medical services are performed in the setting of work: these medical programs are little concerned with the working environment. Steadfastly industrial medicine has declined to extend its services to the worker's family and other dependents or even to the worker himself beyond the medical status of work origin. The worker is told to "Seek out your family physician" in all major medical situations unrelated to work causation.

Much in the industrial medical program represents requirements imposed by law upon industry in the protection of its workers. Any measure for industry to extend industrial medical services to all the worker's family would not have the support of industrial physicians and would stir the ire of the general medical practitioner. Were that to take place, industrial medicine would become medical care. Clarification centers about the industrial physicians "ministrations" versus his "obligations." As to "ministrations," his field of activity is the work environment and workers in that environment. Obligation is much larger and less restricted. He becomes a part of every health procurement, conservation, and perpetuation measure. He will do well to know much about medical care programs, to foster the good ones and oppose intelligently the undesirable ones, to counsel workers, advise industry, and sit on boards and committees. The industrial

physician should be the best informed person on medical care programs in his industry. —A.B.

Internal Medicine

The Internist and Cardiac Arrest. S. L. Cole and E. Corday. A.M.A. Arch. Int. Med. 104:37 (July) 1959. (*University of Southern California School of Medicine, 1200 N. State Street, Los Angeles 33)

The role of the internist in the prevention and management of cardiac arrest has not been clearly defined. In the operating room he may be of invaluable assistance to the surgeon in the matter of drug administration, etc. even though the latter may consider himself responsible from the medicolegal point of view. Preoperative detection of cardiorespiratory disease or defects and their correction is of basic importance if the frequency of cardiac arrest is to be minimized. Great emphasis is placed upon the urgency of the situation. Only 2 of 30 patients survived when a delay of four or more minutes in reinstituting the heart beat occurred. In both permanent central nervous system damage developed.

The internist may meet with cardiac arrest in a number of situations—coronary artery disease, Stokes-Adams attacks, drowning, electrocution, toxic reaction to drugs, etc. In such situations the internist should not attempt thoracotomy unless a surgeon is "readily available" and "an anesthesiologist to insure oxygenation through an adequate airway." —L.W.

Personality Factors and Pressor Mechanisms in Renal and Essential Hypertension. A. O. Ostfeld,* and Binyamin Z. Lebovits. A.M.A. Arch. Int. Med. 104:43 (July) 1959. (*Department of Preventive Medicine, University of Illinois College of Medicine, 840 S. Wood Street, Chicago)

Emphasis upon the possible etiologic role of psychological factors in "essential" hypertension led the authors to a comparison of test results in a group of 15 "renal" hypertensives with those in a group of 18 "essential" hypertensives. Two tests were used: the Minnesota Multiphasic Personality Inventory and the Rorschach. The test score patterns were markedly similar in the two groups. Physiological observations on the two groups included blood pressure response to tetraethyl ammonium chloride (TEAC) and the response of the minute vessels of the bulbar conjunctiva to topical application of levarterenol under varying circumstances. The blood pressure responses to stress and the accompanying changes in vascular reactivity were very similar in the two groups. The authors conclude that the role of psychological stress must be very similar in the two kinds of patients and hence not etiologically related to the "essential" cases. The similarity of the changes in vascular reactivity in the two groups supports the thesis that the same mechanism is responsible for elevations of blood pressure in threatening situations in the two groups. —L.W.

Severe Infectious Mononucleosis Treated with Prednisolone. M. C. Creditor* and H. W. McCurdy. Ann. Int. Med. 50:218 (Jan.) 1959. (*The Menorah Medical Center, 4949 Rockhill Road, Kansas City 10, Mo.)

Infectious mononucleosis ordinarily is a benign disease and requires only symptomatic treatment, but fatal complications such as Guillain-Barré syndrome, obstruction of the respiratory tract, diffuse involvement of the nervous system, rupture of the spleen, and generalized "toxemia" may occur. The authors present the case of a 16-year-old girl in whom death seemed imminent because of generalized "toxemia," progressive upper respiratory obstruction, and probable involvement of the central nervous system. She was given 50 mg of prednisolone in 2 liters of dextrose intravenously. Within 12 hours after this therapy was begun, the spiking temperature became normal, lethargy was replaced by alertness, and pharyngeal edema subsided. The patient was able to be fed orally. The improvement was sustained, and the usual asthenia occurring in convalescence was not present. The authors suggest that steroid therapy may have been responsible for this state of relative well-being. —S.H.S.

Panic and Phobia: A Possible Method of Treatment. N. Malleson.* Lancet 1:225 (Jan. 31) 1959. (*Physician in Charge, Student Health Association, University College, London, W.C.)

Instead of the usual therapy of sedation, reassurance, protection, and comfort in patients suffering from panic and phobia, the author has encouraged them to experience the fear with all the ramifications of unpleasant emotions and bodily sensations that are aroused. The patient must learn to accept the situation causing fear and not to try to escape from it. The patient allows himself to imagine the awful consequences he feels will result from his seemingly intolerable situation and failure.

An example is given of a student experiencing panic prior to an examination. By forcing himself to imagine all the consequences of failure, such as familial disappointment, derision from his associates, and financial loss, eventually he became totally unable to be frightened, and successfully passed the examination. Should the patient tend to repress his fear, he then should force himself to face his problem realistically. If therapy is to be successful it is important that the individual not only experience fear, but that he run the gamut of all the unpleasant emotions and bodily sensations aroused. The author believes this therapy can reduce phobic difficulties and free life from much restriction.

NOTE: I abstract this article with more than passing interest, since Dr. Gerald A. Gordon, Chief of the Psychiatric Department of the E. I. du Pont de Nemours Company, Wilmington, Del., has for the past decade strongly advocated this therapeutic approach in various conditions, such as anxiety, phobias, and mild schizophrenia. —S.H.S.

About the Authors

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4. Kligman, A. M.: J.A.M.A., 171:592, (Oct. 3) 1959.

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About the Authors

organization's medical program.

Rehabilitation and job placement in relation to heart disease have been of special interest to DR. IRVIN. He served three years as Chairman of the Rehabilitation Committee of the American Heart Association. He is Past President of the Michigan Heart Association and the Michigan Industrial Medical Association. He is a Fellow of the American College of Chest Physicians, Specialist certified by the American Board of Preventive Medicine in Occupational Medicine, and a lecturer at the University of Michigan Medical School. He was President of the Industrial Medical Association in 1953.

HAROLD BRANDELEONE, M.D., has been identified for many years with the prevention of accidents by bus drivers. The article in this issue of which he is author, "Heart Disease and Motor Vehicle Accidents," is the latest in a series of his reports and studies of the subject.

DR. BRANDELEONE is a New Yorker. Born in that city, he successively graduated from Friends Seminary and different components of New York University (B.S., M.D., and Med. Sc.D.). He is a member of Sigma Xi and Alpha Omega Alpha fraternities.

DR. BRANDELEONE works part time in industry while he carries on a private practice in internal medicine. His interest in motor vehicle accidents coincided with his medical directorship of the Third Avenue Transit System from 1947 to 1957. He is now Medical Director of The Lionel Corporation. He holds appointments at Bellevue Hospital and University Hospital, and is Associate Chief of the Metabolism Clinic, New York University College of Medicine.

DR. BRANDELEONE is a Specialist certified by the American Board of Internal Medicine, a Fellow of IMA and Chairman of its Committee on Standards for Vehicle Driving.

HARRY B. BURR is Medical Services Administrator of the Westinghouse Electric Corporation. In this capacity he has the responsibility to advise top management in the development of policy governing the administration of company medical services activity and to provide guidance and assistance to line management in administering this activity. The accomplishments of this administration include progress toward a goal of management health examinations of uniformly high quality at the firm's various locations across the country. The statistical reports of these examinations in part have provided the basis for the analysis Mr. Burr presents in his article in this issue, "Westinghouse Management Health Examinations — Their Investment Value."

MR. BURR is a native of Michigan, holds an A.B. degree in economics from the University of Michigan, and has carried on graduate studies in economics at Wayne State University. His association with the field of industrial medicine began in 1940, when he became business manager of the medical departments of Chrysler Corporation. The vast, far-flung war-production activities of that firm presented unusual opportunities to gain experience in the administrative aspects of industrial medicine. He joined Westinghouse in 1954.

FRANK PRINCI, M.D., is author of the topical review in this issue, "The Effects on Man of the Absorption of Fluoride." DR. PRINCI, a native of Boston, received his university education at the University of Colorado. He received the B.A. and the M.D. degrees from that institution, and he continued work in industrial hygiene and general medicine under a Rockefeller Foundation fellowship at Colorado and in the Department of Clinical Physiology at Trudeau Sanatorium.

DR. PRINCI'S military service, from 1942-1946, included active support of ground troops in the European Theatre of Operations. He received the Bronze Star Medal with Oak Leaf Cluster.

DR. PRINCI joined the Kettering Laboratory at the College of Medicine of the University of Cincinnati about 10 years ago. He is now Associate Director of Kettering Laboratory and Professor of Industrial Medicine, with direct responsibility for the graduate training programs for which the institution is well known.

For several years DR. PRINCI has been Secretary, Section on Preventive Medicine, American Medical Association. In 1955 he was president of the American Academy of Occupational Medicine. He is certified in Occupational Medicine by the American Board of Preventive Medicine, to whose program of certification he has made substantial contributions. He has for several years been a member of the editorial board of *A.M.A. Archives of Industrial Health*, and from the beginning he has been on the editorial board of the JOURNAL OF OCCUPATIONAL MEDICINE. His own publications have been principally concerned with occupational diseases.

HERBERT T. RANSDELL JR., M.D., is Assistant Professor of Surgery at the University of Louisville, a position he has held since 1953. A native of Louisville, DR. RANSDELL received the M.D. degree from that city's university in 1941, and during the next 10 years advanced through internship and residencies in general surgery and thoracic surgery at Grady Hospital, Atlanta, Ga.; Veterans Administration Hospital, Louisville, Ky.; Battey State Hospital, Rome, Ga.; and University Hospital, Augusta, Ga. The decade saw a four-year interruption for military service in the Army, during part of which DR. RANSDELL served as battalion surgeon with the rank of captain.

DR. RANSDELL is certified as a Specialist by the American Board of Surgery and the American Board of Thoracic Surgery. He is a member of the American Trudeau Society, the American College of Surgeons, and the American Association for Thoracic Surgeons. He is Chief Surgeon, Waverly Hills Sanatorium, Louisville.

DR. RANSDELL'S contribution to this issue is Part II of the large surgical review coming from the University of Louisville on Industrial Trauma. His specific subject is "The Emergency Treatment of Thoracic Trauma." Some of his earlier publications deal with pulmonary complications of diaphragmatic hernia, tracheostomy, and gunshot wounds of the heart.

People and Events

► JOHN G. PIFER, M.D., has been appointed Medical Director of the East Pittsburgh Divisions of Westinghouse Electric Corporation succeeding FRANK E. GRAY, M.D., who has retired. Prior to his appointment as Medical Director, DR. PIFER served as Assistant Medical Director for the Westinghouse East Pittsburgh Divisions.

After graduating from Duquesne University in 1942, DR. PIFER received his M.D. degree from the University of Pittsburgh in April, 1948. He interned at the United States Naval Hospital in Philadelphia. In 1949, he joined the Westinghouse East Pittsburgh Medical Department and served in the capacity of staff physician until his appointment as Assistant Medical Director in 1957.

DR. PIFER is a member of the Industrial Medical Association of Pittsburgh and the Industrial Medical Association.

► JOHN F. COYNE, M.D., has been appointed Medical Director of the Sharon plant, Transformer Division, Westinghouse Electric Corporation. He was formerly Medical Director of the Janesville, Wisconsin, plants of the Fisher Body and Chevrolet Divisions of General Motors Corporation.

DR. COYNE received his M.D. degree from the University of Pittsburgh in 1949, and interned at Hurley Hospital, Flint, Michigan. From 1950 to 1952 he was on activity duty as a U. S. Air Force Medical Officer and was stationed at F. E. Warren Air Force Base, Cheyenne, Wyoming. In 1952 he became engaged in the general practice of medicine as a member of the Fond du Lac Clinic, Fond du Lac, Wisconsin, continuing there until 1956 when he entered upon a full-time career in industrial medicine with General Motors at Janesville.

DR. COYNE is a member of the Central States Society of Industrial Medicine and Surgery and the Industrial Medical Association.

► Employment problems, in connection with a list of chronic diseases, was the general theme of the 1959 Winter Meeting of the Central States Society of Industrial Medicine and Surgery held at St. Louis on December 5. The meeting used the format of focusing on a given problem through the viewpoints of a list of professional specialties and disciplines. The essential subject matter for each discussion was provided by well-known authorities as follows: heart disease, PAUL D. WHITE, M.D., Boston;

Pictured at the 1959 Winter Meeting of the Central States Society of Industrial Medicine and Surgery are (left to right): Rev. Denton M. Gerow, D.D., Robert J. Ryan, D. John Lauer, M.D., Richard A. Sutter, M.D., Paul Dudley White, M.D., Bille B. Hennan, M.D.

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People and Events

diabetes, JOSEPH T. BEARDWOOD, JR., M.D., Philadelphia; Gerontology, WILLIAM B. KOUNTZ, M.D., St. Louis; tuberculosis rehabilitation, RALPH W. SUSMAN, New York; and mental health, LOUIS BELINSON, M.D., Deputy Director of the Division of Mental Diseases of the Missouri State Department of Health. The addresses and discussions of the day were summarized by ADOLPH G. KAMMER, M.D., editor of the JOURNAL OF OCCUPATIONAL MEDICINE. The meeting was under the general direction of RICHARD A. SUTTER, M.D., St. Louis, the President of the Society.

► ANTHONY A. MIRA, M.D., has been appointed Medical Director of the General Telephone Company of California in Santa Monica. Since 1957 he has been Director of the Bureau of Industrial Health and Workmen's Compensation of the Medical Society of the State of New York.

DR. MIRA received his M.D. degree in 1933 from the George Washington University School of Medicine in Washington, D.C.

From 1941 through 1945 he served with the U.S. Army, spending nearly three years in the Southwest Pacific area as chief of a surgical service. He was Medical Director of the New York City Department of Welfare from 1945 to 1954 and has also served as Medical Director of Sun Chemical Corp., and Gimbel Brothers in New York City.

DR. MIRA is a Fellow of the Industrial Medical Association, the American Public Health Association, and the New York Academy of Medicine. He also has served actively in the New York State Society of Industrial Medicine, the Queens County Medical Society, the Medical Society of the State of New York and the American Medical Association. He was a member of the Advisory Committee and the Board of Directors of the Brooklyn Tuberculosis and Health Association, the Workmen's Compensation Board of the State of New York and the New York City Welfare Department, and has served as a special examiner to the New York City Department of Education.

► JOHN ALLEN, M.D., has been named Chief Medical Consultant to the State of Wisconsin Public Welfare program. He will correlate all medical programs between federal, state and county agencies as well as rehabilitation and work evaluation clinics. He has been Corporation Medical Director for Oscar Mayer & Company in Madison, Wisconsin, for the last seven years.

DR. ALLEN received his M.D. degree from the University of Wisconsin in 1951 and interned at Madison General Hospital. He is currently a lecturer in occupational medicine at the University of Wisconsin's Medical School.

► JOSEPH MICHAEL PISANI, M.D., became Medical Director of the Union Family Medical Fund of the Hotel Industry of New York City on February 1. He had been Medical Director of the Bankers Trust Company, New York City, since 1957.

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DR. PISANI will supervise the Fund's medical staff. He received his A.B. degree from Fordham University in 1938 and his M.D. degree from New York University College of Medicine in 1942. During World War II he was a captain in the U.S. Army, serving 14 months in Italy and North Africa. He has held posts in administrative medicine with the U.S. Department of Defense and teaching posts with the State University of New York, College of Medicine in New York City. He is a member of the New York State Society of Industrial Medicine.

► R. EMMET KELLY, M.D., Medical Director for Monsanto Chemical Company, St. Louis, has been appointed chairman of the Medical Advisory Committee of the Manufacturing Chemists' Association. The committee's advisory service includes the preparation of information on the toxicology of industrial chemicals, on medical treatment for exposure and essential first aid measures for publication in the Association's widely recognized chemical safety data sheet series.

DR. KELLY received his M.D. from St. Louis University in 1932. He was appointed Medical Director of Monsanto in 1936, serving until 1942 when he joined the U.S. Army. Discharged in 1946 with the rank of lieutenant colonel he returned to Monsanto.

In addition to his industrial work DR. KELLY is senior instructor in internal medicine at St. Louis University, a member of the board of directors of the St. Louis Heart Association, member of the council of the American Therapeutic Society. He is a Fellow of the Industrial Medical Association and is active in a number of other professional societies. The vice-chairman of MCA's Medical Advisory Committee is T. W. NALE, M.D., Medical Director of the Union Carbide Corporation, New York.

See President's Message (page 103) regarding the coupon below.

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. . . *Psychology and The Behavioral Sciences*—Research and evaluation of crew selection and performance, psychological stresses, stimulus and response characteristics, and simulation.

. . . *Engineering Integration and Analysis* – Development of escape and survival equipment, safety design and fabrication, emergency detection and repair, and operations analysis support.

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► LOGAN T. ROBERTSON, M.D., will be moderator at a workshop session on "Health Maintenance—Its Contribution to Job Safety," at The President's Conference on Occupational Safety which will be held March 1-3, in Washington, D.C.

HAROLD J. MAGNUSON, M.D., will be moderator of another session entitled, "Emerging Environmental Hazards." Consultants for this session will be HERBERT K. ABRAMS, M.D., and WILLIAM G. GRIFFIN. Panelists will be JOHN A. ZAPP, JR., PH.D., ARAM GLORIG, M.D., and CHARLES R. WILLIAMS, PH.D.

The central theme of the Conference will be "The Challenge of Safety in a Changing World." CLARK BRIDGES is serving as Program Consultant for the Conference.

► The Eighth Congress of the International Union of Railway Medical Services (U.I.M.C.) was held at Lucerne, Switzerland during the week of September 21, 1959. Representatives of the medical services of 28 nations attended this session. The Industrial Medical Association was represented by W. J. GERSTLE, M.D., of New Cumberland, Pennsylvania, and J. M. BREWSTER, M.D., of Philadelphia, Pennsylvania. DR. GERSTLE presented a paper on "Disability Retirement and Mortality of American Railroaders."

At its conclusion, the Congress adopted the following resolutions:

1. Statistical methods, based on a large number of records in related and homogenous groups, again have proven their value for developing facts and preventive measures for the correction of undesirable or hazardous conditions.

2. While it was not established that there are pathological conditions peculiar to the Railway occupations and environments, the study emphasized, primarily, the importance of cardiovascular conditions and cancer, and secondarily, psychosomatic illnesses. The findings were considered to justify a more extensive study of these three conditions over a period of several years, and it should include statistics covering retired employees.

3. In their common interests, Railroad Management and its workers should make use of all means which tend to maintain the optimal physical and mental health of the employees until the normal retirement age is attained. This can be achieved by close cooperation of the Railroad Medical Department with all others. The provision of the following measures are considered to be important in this respect: (a) careful and detailed pre-employment examinations; (b) improvement of the psychological climate in the working environment; (c) job analysis; (d) general extension of periodic medical examination; (e) the development of rehabilitation methods and reclassification of partially disabled personnel.

► The annual Congress on Industrial Health, sponsored by the Council on Industrial Health of the American Medical Association, will be held in Charlotte, North Carolina, on October 10-12, 1960. Cosponsors will be the North Carolina Medical Society, the North Carolina Occupational Health Council and the Greater Charlotte Occupational Health Council.

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*Peck, S. M., and others: A.M.A. Arch. Dermat. and Syph. 67:263, 1953.

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